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Introduction to

INTRODUCTION
to
HEALTH STATISTICS

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INTRODUCTION

to

HEALTH STATISTICS

FOR THE USE OF HEALTH OFFICERS,
STUDENTS, PUBLIC HEALTH AND SOCIAL WORKERS ETC.

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Foreword

It is always a privilege to write a preface to a book when its author has both wit and a sense of serious purpose. Dr. S. Swaroop has these qualities, and they add distinction to a work which deals largely with the realities of everyday practice. It is written especially for the benefit of the health officer who has not the advantage of a great statistical department at his elbow. There are in the world today a large and increasing number of health officers who are faced with compelling problems of danger and disease; their most urgent need is training in methods of procedure, and above all, in preparation for the collection and interpretation of accurate and useful information about the population of the area in which they serve. With a working knowledge of vital and health statistics the health officer is well armed for any emergency. This book offers this knowledge in a practical - and readable - form, and it is a valuable manual of reference.

Dr. Swaroop has himself visited many countries and given courses of instruction on health statistics. He has first-hand knowledge of many of the challenging problems as they arise in health departments, both small and great, as well as in the countries which are now only on the threshold of development. He himself comes originally from a rapidly expanding country and has an intimate feeling of the difficulties inherent in the various stages of progress. The book is based on personal experience, and also on the wider opportunities of sifting and enlarging the experience of colleagues and students. It is to be commended also as a textbook in teaching institutions.

1960

JAMES MACKINTOSH

Preface

During the long period — nearly a quarter of a century — in which I have been engaged in the study and practice of health statistics it has been my privilege to discuss the subject with quite a large number of fellow workers at the local, intermediate, national, and international levels. I have not yet met any two health statisticians whose interests in this field have been identical. The diversity of tasks and problems in this seemingly restricted area has led individual workers to view their responsibilities in different ways, in harmony with their primary interest. Their number is legion today, and they are constantly adding to methodology and knowledge in this expanding science. At the same time we should not forget that equally significant contributions are being made by millions of people throughout the world who, although untrained in the techniques of health statistics, are nevertheless adding in one way and another to the ever-accumulating fund of basic numerical information on events of importance to health and vital statistics, events that recur continuously wherever human beings dwell.

All over the world varying systems for collecting health statistics operate with varying degrees of efficiency. In some highly developed countries the processes are so well advanced that for each individual the records begin even before birth and progress steadily through the advancing years. At the other extreme of development the remotest dispensary may have a mechanism for recording the persons treated and the treatment given. If we reckon that at least one individual from each household is responsible for reporting or recording, the number of the "computers" must indeed run into hundreds of millions. Moreover, the processes of picking up the information from households, with the subsequent collation, interpretation, and analysis, are expanding to cover more and more areas and events. Truly, "like a swarm of bees that build a beautiful hive according to the laws of geometry, each doing its part in obedience to a mystic urge", these uncountable persons are also building and expanding an orderly edifice of knowledge of health statistics "according to conscience and the sense of truth" that is in them.

Important advances are being made in statistical methodology. While a knowledge of advanced statistical theory is necessary for professional statisticians, the subject as practised in health agencies raises several problems in addition to methodology such as those related to administrative, social, economical, cultural or psychological considerations, and others which are procedural, technical, legal or financial. The main problem then is how to apply statistical knowledge in the day-to-day working of a health agency.

While, therefore, we have the art and science of applying statistical methods to the analysis and interpretation of data, we also have the problem

of assembling meaningful basic statistical material and its presentation. Both are of fundamental importance as is illustrated by the following example: Sometimes we are invited to tea by ladies who claim to be expert in the art and science of preparing and serving it. They take great pride in presenting it correctly. In Japan this art and science involves a special ceremony, to master which, girls are trained over long periods — sometimes longer than a health worker spends on his statistical training. In a similar way the health statistician is expert in his art and science of interpreting the data and presenting his results. But like the tea in the packet the essential figures have already been assembled for him in the individual cells of a statistical table. But let us not forget what precedes the eventual appearance of the elegant infusion on the lady's table. In China, India, Burma and Ceylon great mountainsides are covered with tea plants. Innumerable labourers, not highly paid and poorly educated, work under the tropical sun and rain, moving from plant to plant plucking just those leaves their skilled judgment tells them are mature. The individual collections in the aggregate amount to millions of leaves which are processed and packed for distribution. Similarly, millions of individuals, not highly educated and often poorly paid, are charged with the duty of visiting from home to home, collecting from each bits of information on paper. These pieces of information are collected with judgment to conform to the requirements of the statistical office. In bulk these collections mount up to millions of items which in turn are processed by means of punched cards and machines for redistribution, in columns and rows for use as individual cell totals on a statistical table.

A vast organization is constantly at work, and it is on the efficiency of this data collecting and producing machinery, if we may so term it, that the quality of the final product is judged. This gigantic machine has to be operated without friction or breakdown; its component parts have to be kept in good working order, faults anticipated, spare parts provided, raw material fed into the machine for processing, and the installation kept up to date. More than anything else, the machine requires lubrication and fuel to make it go.

The aim of this book is to offer a brief account, for those who take part in administering this great enterprise, of what is actually happening in the process. It indicates what advances are being made and how each one of us can play his part in developing a system that will help mankind towards more vigorous health and longer life.

Geneva, 1960.

SATYA SWAROOP

Acknowledgements

No words of acknowledgement can adequately convey my debt of gratitude to Professor James Mackintosh for his painstaking assistance and constant encouragement without which this book would not have seen the light of day. In addition to agreeing to write the foreword he has helped me with a number of new ideas and with critical examination of the manuscript.

I should like to mention specially the valuable opportunity given me to present a course in health statistics at the Johns Hopkins School of Hygiene and Public Health, Baltimore, Md., by Professors E. L. Stebbins, W. G. Cochran and M. Merrell.

I am indebted to many friends for their shrewd and helpful criticism and would like specially to mention Dr. Enid Charles. It would be difficult to mention all others by name, but I received much practical assistance from my own colleagues in the preparation of the manuscript.

Miss Dora Howe in her spare time has been most helpful in checking the text and references, and I owe a debt of gratitude too to Miss Stella Howells for her skilled assistance.

Finally, I should like to record my appreciation of the encouragement given me in the completion of the book by Dr. Yves Biraud, Director of the Division of Health Statistics, World Health Organization.

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I. LAYING THE FOUNDATIONS

CHAPTER 1

The Role of Statistics in Public Health

1.1 Why do we need statistics in a Health Department?

Events of vital importance to the public health worker occur in the lives of all. Not only the major events of birth and death, which determine the bounds of existence, but also the occurrence of diseases and disabilities, lie within his sphere. The health worker is interested in knowing how many persons fall ill or die, and he is also concerned with finding out the disease or injury responsible for each illness or death, and ascertaining the circumtances in which the event takes place. But this is only a beginning: information is also needed on many matters such as the age at which the various upsets take place, whether they are equally distributed between men and women, what areas of the city or province are more heavily affected than others, and by what diseases; there are questions, too, about a seasonal rise in certain diseases, or the adoption of preventive measures like vaccination against smallpox or spraying of insecticides against malaria, and the extent of the success they achieve.

The important thing is that most of these events can be counted. For this reason they have become the foundation of public health activities, for records represent both knowledge and truth. It has been well said that "when you can measure what you are speaking about and express it in numbers, you know something about it; but when you cannot measure it or express it in numbers, your knowledge is of a meagre and unsatisfactory kind".

The function of a statistician in the public health department is to collect, interpret and present numerical information that is relevant, reliable, complete, comparable and up-to-date. On this secure foundation the administrator, instead of having to rely on vague impressions, can know exactly what is happening in the population under his care, and how best to organize and utilize his limited staff and resources to build a sound structure of health. Experienced public health administrators have described statistics as "the eyes and ears of the public health worker", and this comes near the truth, for in the absence of proper statistical information he will be blind and deaf to his responsibilities. It may be that one area suffers a high mortality from malaria, another a serious degree of debility on account of tuberculosis or hookworm, and yet another from an insidious loss of efficiency as a result of widespread eye diseases. In a less developed area people may be dying in great numbers from epidemics of typhus or cholera; yet if the health officer cannot inform himself promptly of what is really wrong, and the extent of the damage, his preventive staff are working in the dark, and time and

money are being wasted. They are playing fast and loose with human lives. With reliable information, on the other hand, the health officer can feel the pulse of the community he serves.

It should hardly be necessary at this stage of national development to lay stress on the value of statistics, but time and again their functions and limitations have been misunderstood. For this reason, as far back as 1937, when an Inter-Governmental Conference on Rural Hygiene was held in Java, the assembled health authorities passed the following resolution:

> "As ultimately the preventive and curative work must be organized on a basis of accurate knowledge of the diseases and disabilities in an area, the importance of collecting accurate vital statistics cannot be over-emphasized".

As time went on similar, even stronger, resolutions were passed at regional conferences and at the international level it is significant to observe that at the First World Health Assembly — held in 1948 — an international regulation relating to health statistics was passed. In whatever form this need is expressed, the fact is clear that unless there is a regular and swift flow of accurate statistical information bearing on birth, death, the incidence of individual diseases, and all the many hazards of life, the staff of health departments are groping in the dark. This is no less true of those who are working in specialized fields such as malaria, tuberculosis, cancer, heart disease, general epidemiology, as well as in the positive-health range of study like nutrition, maternal and child health, mental health, and environmental sanitation.

1.2 The special uses of health statistics

It is by no means an easy task to set up a system that will ensure accurate recording of numerical information for each vital event occurring in a country, in each and every town, village, institution, and individual home. In many of the less developed countries a system of this kind does not exist; and even where considerable advances have been made, statistical services have expanded only after many years of effort, and improvements are still being effected. There are thus many countries in which statistics have yet to be "sold" to the government and the people. It has to be clearly understood that this is the only way in which the level of health can be measured, and effective comparisons made. To take a specific example: if a disease, or the cause underlying each death were carefully recorded for a city over a number of years, we could provide correct answers to the following questions:

1. What is the leading cause of death in this city? Is it malaria, tuberculosis, cancer, or accidents, or some other cause as yet unsuspected?
2. At what age is the mortality highest, and from what disease?
3. What sections of the city are the most unhealthy, and what is the outstanding cause of death there?
4. How much reduction in mortality might one expect from such public health measures as smallpox vaccination or malaria eradication?
5. In comparison with cities of similar size in other countries is this city healthy or not?

6. In what sections of the city, as judged by the death rate, is improvement being achieved? In which parts, on the other hand, is disease on the increase?

7. Are certain diseases affecting specified groups of the population more than others? (This might apply, for example, to women or children, or to individuals following a particular occupation.)

8. To what extent are the hospital facilities, staffing, drugs, and equipment able to cope with the disease problem?

9. Is there any season at which various diseases have a tendency to break out? If so, can these be distinguished?

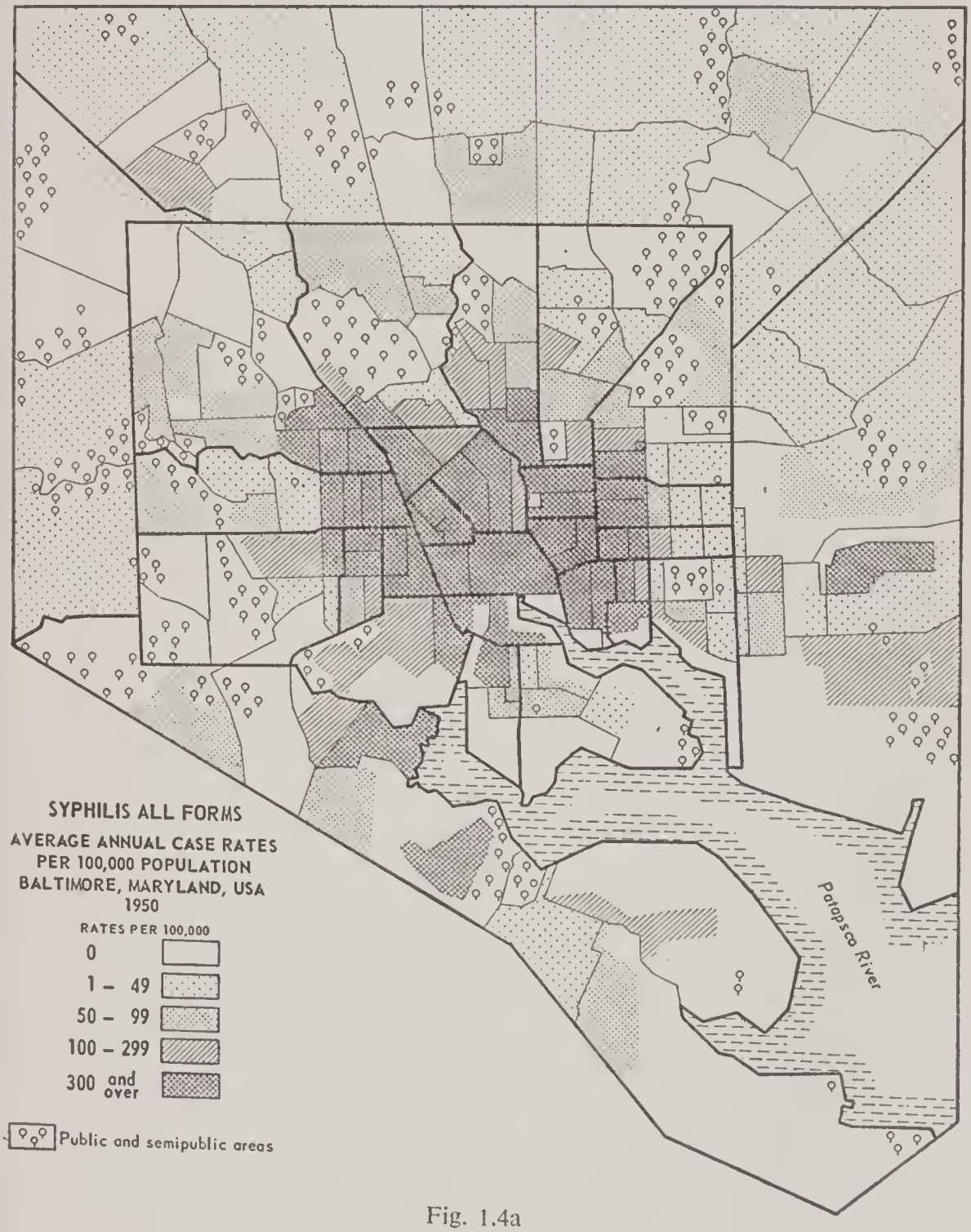


Fig. 1.4a

1.3 Utilizing the data

To answer the foregoing questions, the data are studied: firstly as actual counts (total population, births, deaths, etc.) to form an idea of the magnitude of the health problem; secondly as indices; rates, ratios, etc. for purposes of making comparisons with other areas; thirdly, by presenting the main findings by means of maps, charts, or diagrams.

1.4 Maintenance of charts

It is customary for statisticians to maintain charts to give rapid visual information about the progress of various diseases.

1.4.1. Maps showing the geographical distribution (Fig. 1.4a). These can be drawn, if there are reliable figures for the total number of persons attacked by, or dying from, each disease. Periodic studies of these maps will show at once which areas are the worst affected, so that effort can be concentrated on them.

1.4.2 Seasonal charts of individual diseases are drawn on the basis of the total number of cases occurring from week to week or month to month in each community. When these charts are kept up-to-date, it is easy to follow the trend of each disease, as was done for example, by the City Health Department, Baltimore, USA, during the world-wide epidemic of influenza in 1957. (Fig. 1.4b.) The current experience is charted in relation to the incidence of the disease during the previous seven years. When the charts are studied over a number of years, they show in what seasons a disease has a tendency to increase or diminish. The knowledge so acquired guides or forewarns the health officer to mobilize his staff and resources *before* the onset of the epidemic season for each individual disease.

1.4.3 Figures collected over a number of years can be plotted on charts to show long-term trends in any disease or cause of death. For instance, a chart indicating the total number of annual cases or deaths in a city would show whether the disease was being brought under control. Fig. 1.4c illustrates for example that while a marked reduction was achieved in mortality from plague, smallpox continued at almost the same level throughout the last half-century. If, in spite of a vaccination campaign, there was no substantial decrease, then it would be clear that more concentrated action was required. Again, if a particular disease in a district shows a consistent increase from one year to another, it is a warning to the health officer to tighten his measures of control. On the other hand, if the deaths from, say, typhoid fever indicate year by year a notable reduction, the authorities can take legitimate pride in asserting that their control measures have been effective and so convince the people that their money has been well spent. No evidence is more convincing to the layman than adequate statistics, when they are presented properly in the form of charts.

1.5 Need for detailed studies

Another useful function of statistics is that it provides knowledge and understanding of the relationships of the various factors involved in the

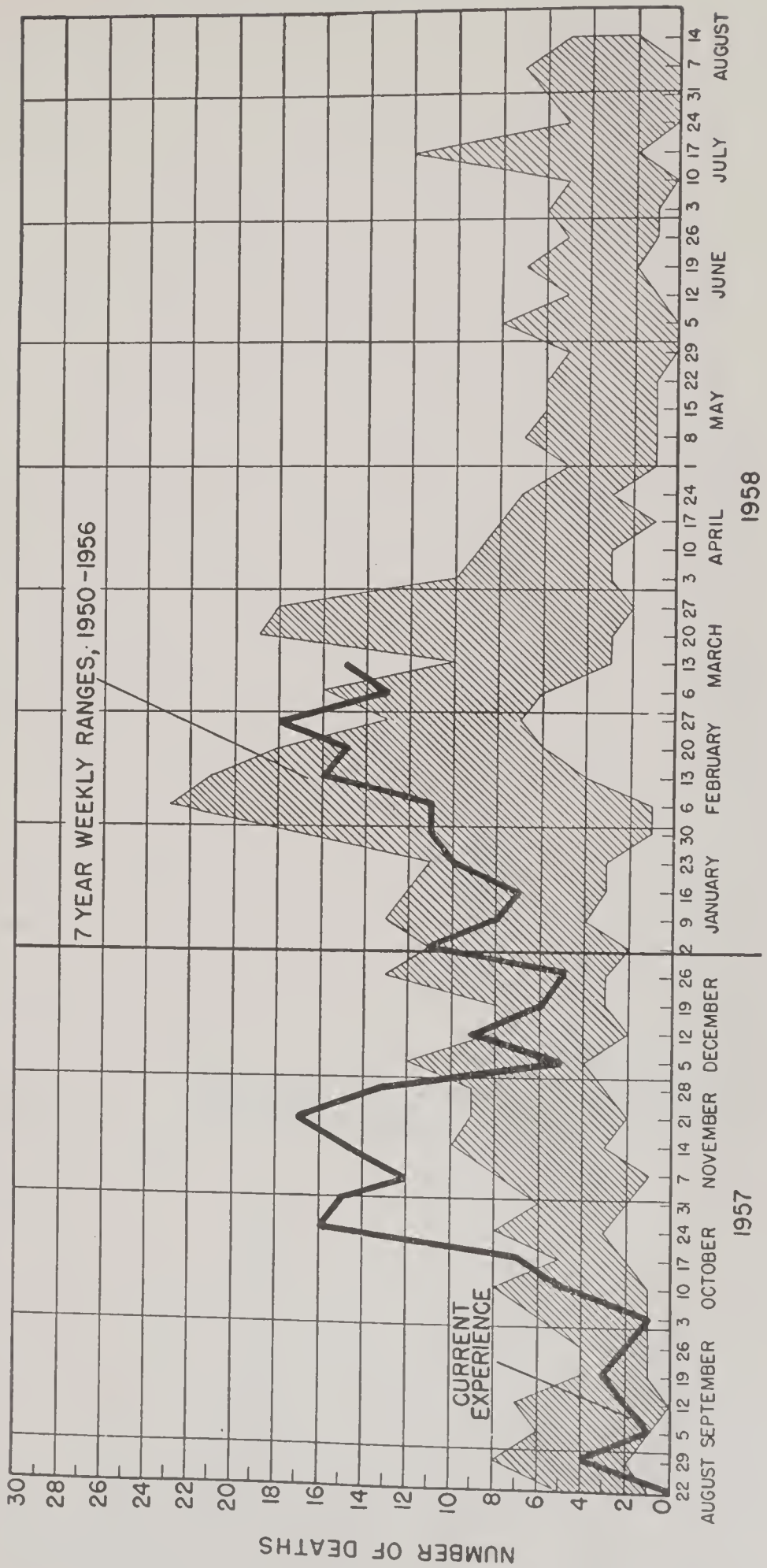

BALTIMORE'S EXPERIENCE
INFLUENZA AND PNEUMONIA DEATHS
By Weeks for 1957-58 Compared to the 7 Year Weekly Ranges for 1950-56
7 YEAR WEEKLY RANGES, 1950-1956
CURRENT EXPERIENCE
NUMBER OF DEATHS
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
22 29 5 12 19 26 3 10 17 24 31 7 14 21 28 5 12 19 26 2 9 16 23 30 6 13 20 27 6 13 20 27 3 10 17 24 1 8 15 22 29 5 12 19 26 3 10 17 24 31 7 14
AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST
1957
1958

Fig. 1.4b

ANNUAL DEATHS FROM PLAGUE AND SMALLPOX IN BOMBAY STATE
1901-56

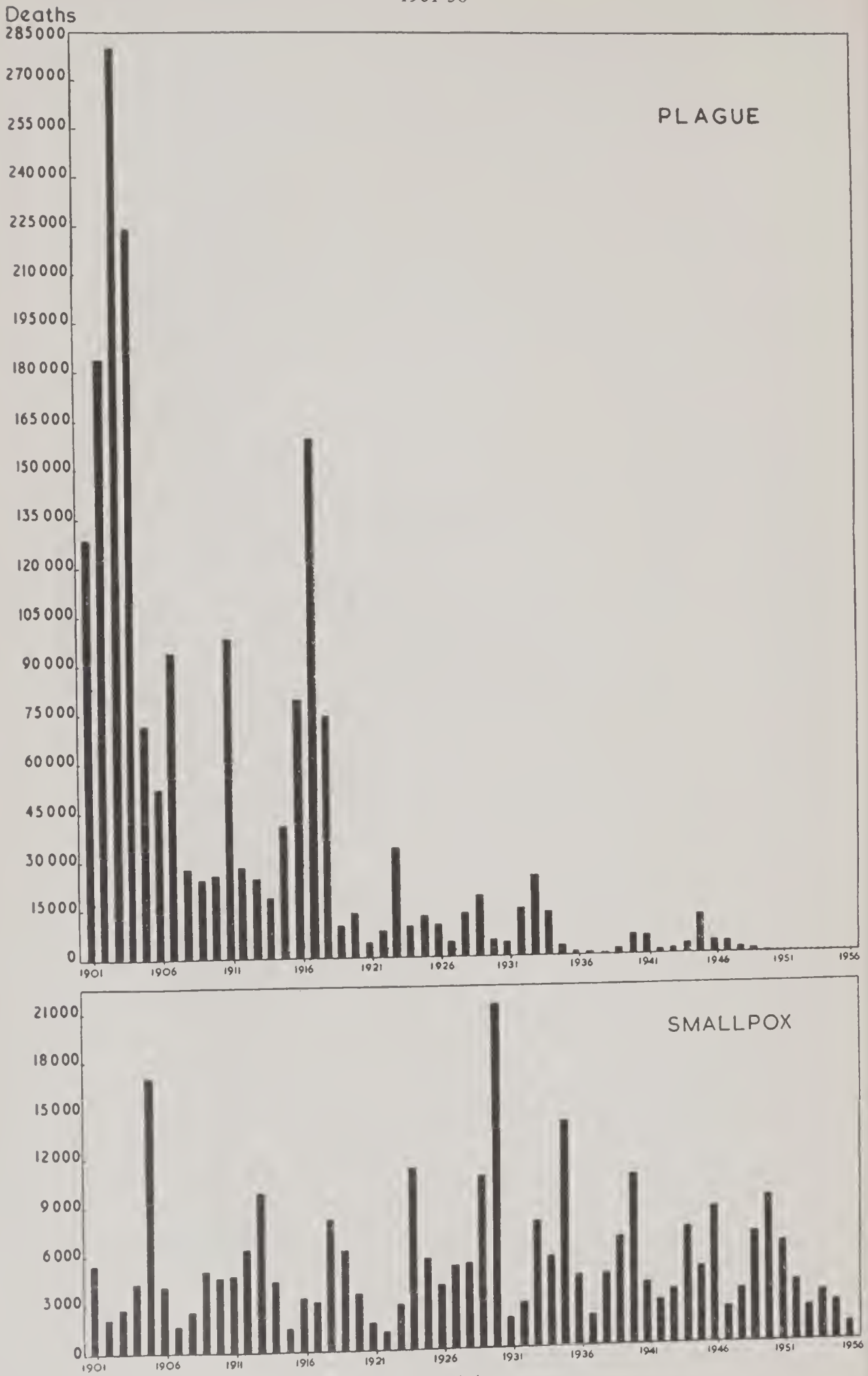


Fig. 1.4c

incidence of disease. Very often the study demonstrates how some of the problems can be tackled both economically and effectively. It leads to the most *feasible* solution. An investigation of smallpox incidence, in one of the States of India, with a population of 30 million shows what can be done. In this State vaccination was introduced as early as 1867, and sufficient vaccine had been produced for a long time. In spite of the fact that a large number of vaccinators had been operating throughout the State for three-quarters of a century, the incidence of smallpox remained disquietingly high. Mortality figures could be obtained on a monthly basis — not always very complete or reliable — for individual localities throughout the State for periods covering nearly eighty years. A careful study of these was made in the hope that they might offer some clue to where the fault lay. The time was well spent because it showed a number of weak links in the administration. It became evident, for example, that the incidence was lowest in places nearest the headquarters of each district. It rose towards the periphery. One could see that either the remoter places were not visited by the vaccination staff on account of the difficulties of travel, or that the vaccine lost its potency in the course of travel. In any case it was clear that the people at a distance needed more intensive care.

A study of the trends of smallpox infection by sex also revealed some interesting and useful information. Around 1900 the death rate of the sexes was about equal, but four decades later, the female death rate had become one-and-a-half times that of the male. The investigation showed that the "protection" of females had fallen by about a third during the forty-year period.

Again, it has been noticed that in many highly developed countries there is a shift of smallpox incidence to the higher ages. In this Indian State there was a movement to the lower age-groups as well, mostly under one year. Further enquiry showed that this was attributable to the appointment of vaccinators who, although better qualified and given higher status, had been expecting people to visit them in some central place instead of vaccinating each member of a household by door-to-door visits as was done previously. This practice made it difficult for women occupied in household work or with young babies to come out of their homes at the stipulated hour to seek protection against the disease.

Studies of this kind make it clear that statistical enquiries may be of benefit to health departments not merely in the more dramatic discoveries, but also in the little day-to-day findings that make for economy and efficiency.

The question has sometimes been asked in a semi-jocular way: can statistics save lives? Of course the answer is that it cannot do so in the ordinary sense, like penicillin and the great treasure house of modern drugs. At the same time there is no denying that a statistical enquiry made at the proper time and in the right setting can lead to a striking conservation of human life. Penicillin or the sulpha compounds have been found highly efficacious in reducing maternal mortality from puerperal sepsis. Statistical enquiries undertaken in England showed that these remedies could cause a reduction in

maternal deaths of about 30 per cent; but the same investigation demonstrated that at least 40 per cent of the total deaths were due to avoidable causes[1]. These specific factors were shown to be inadequacy of antenatal care, want of obstetrical facilities or other specialized treatment in hospital, or lack of co-operation of relatives and friends. In other words, statistics often have the salutary effect of telling a health department that one positive finding is not necessarily the whole story; there may be other methods of prevention and care of equal cogency. The death rate from a particular cause has often been reduced by correct interpretation of a statistical investigation. The role of the statistician is here an important one; while working side by side with the health officers in the collection of reliable material he interprets the findings so as to strengthen the means of control in the most economical way.

1.6 Appraisal of results

We must now go a step further: people who pay money to finance public health work naturally have a right to know what results are being achieved. Did the spraying of houses by DDT substantially reduce the incidence of malaria? Sometimes the results are so spectacular that no further proof is needed, but this is uncommon when one is dealing with human beings. More often there are "obstinate questionings" about a new procedure, especially if it involves some degree of interference with human freedom. Each programme, be it an immunization campaign against diphtheria or whooping cough, or the mass treatment of hookworm, or the hospital care of tuberculosis, has to defend itself, as it were, by a process of human book-keeping. The statistician has to produce his balance sheet, and present it for public audit. What is the net result of this or that activity? How do we rate with our own past, say a decade ago? In what directions has progress been unsatisfactory? What has been missed, and how much more is needed? This periodic audit is today an essential part of every health programme, and the future work of the department depends on the thoroughness of the appraisal and its clear unequivocal presentation.

1.7 Use of the sampling method

A basic function of statistical services is in the collection of data and, in collaboration with other workers, the preparation of suitable records and procedures for the purpose. If an entire population cannot be examined, the best alternative is to study a sample. This is a highly technical subject, and statisticians specially qualified and experienced in the theory of sampling are taking an increasingly useful part in its application. Sometimes we wish to compare the relative efficacy of certain drugs in the prevention of a disease. Comparable groups of individuals are then required for trials. The choice of these groups requires great care to ensure that they would have an equal chance of contracting the disease if the proposed measures were not applied. Similar considerations apply to studying the effects of treatment.

[1] Vital Statistics in public Health, by W. T. Russell. Public Health, London Vol. 62, No. 1, p. 9. October, 1948.

In countries where a fully satisfactory system for collecting health statistics has not yet been established the sampling technique provides an efficient short cut for many purposes (see chapter 11). The core of the problem is to decide what information ought to be collected, for what purpose and within what limits of error; then to work out procedures for collection. To put the matter more practically, we have to design the forms on which the information is to be entered, to consider the type and number of trained staff required, and discuss the kinds of defect likely to arise in the working of the system. At the same time detailed consideration must be given to where and how the events recorded are to be tabulated, and the meaning of the figures examined and interpreted. The World Health Organization, the United Nations, and other international agencies are helping in this task, but the creation of an efficient system will ultimately depend on the *national* staff and the interest they develop.

1.8 List of uses of statistics

The foregoing paragraphs focus sharply the uses of health statistical information and modern developments in statistical methodology, (viz. techniques or tools for the collection and proper interpretation of numerical information). In later chapters some of these uses are more fully explained and reference is made to a number of other functions of health statistics. Here is a short list. Health statistics are used to:

(a) describe the level of community health;
(b) diagnose community ills;
(c) discover solutions to health problems and find clues for administrative action;
(d) determine priorities for health programmes;
(e) direct or maintain control during execution of health programmes;
(f) develop procedures, definitions, classifications, and techniques such as recording systems, sampling schemes, etc.;
(g) promote health legislation;
(h) create administrative standards of health activities;
(i) determine the met and unmet health needs;
(j) disseminate reliable information on the health situation and health programmes;
(k) determine success or failure of specific health programmes or undertake overall evaluation of public health work;
(l) demand public support for health work.

1.9 Misuse of statistics

The unhappy possibility of drawing wrong conclusions from statistical material has led some people to suspect the value of statistics as a means of assessment. The fault lies not in the methodology but in the misuse of information. Correct interpretative techniques should lead everyone to draw the same conclusions from the same set of data. The term "health statistics" is commonly understood to denote merely the mass of numerical information

collected and arranged in rows and columns of tables — information relating to events of health importance. But the term also connotes the new and developing scientific techniques or methodology for dealing with numerical information; methodology resting on the secure foundation of the laws of probability. Later chapters explain how some of the important techniques could be usefully employed by public health workers, even though they may not feel confident about their mathematical knowledge. Health statistics is to be regarded primarily as a discipline which medical men, mathematicians and others have to acquire, because events of health importance are the result of the interplay of innumerable factors and different techniques are needed to interpret the data.

1.10 Statistics past and future

The field of health statistics is so broad that there is room for every individual to contribute his share. This belief is strengthened by one important historical observation. Health statisticians belong professionally to a line of workers who can be traced back to John Graunt, acclaimed the father of health statistics. Was he a trained statistician? He could not have been; the science of statistics had hardly been developed in 1662 when he published his epoch-making book.[1] "Not professing letters", as he wrote of himself, he was neither mathematician nor physician. His biographers write that he earned his living as a haberdasher in the City of London. But he was interested in the registers containing records of deaths made by the parish authorities. Hundreds of thousands had seen such entries before; the register was full of them, going back more than half a century. John Graunt was different. He conceived the idea of making a study of where and from what causes people died, at what age, in which seasons or years, and so on. By using simple, commonsense methods for analysing the information he formulated certain laws which are as true today as they were in the year 1662. He thus established the uniformity and predictability of many important phenomena taken in the mass. In doing so, he opened the way for the later discovery of other uniformities in events of health importance and for their further study. That curiosity, and that desire of his to study and interpret information, set in train what has become a worldwide undertaking, utilizing enormous staff and equipment, contributing to the saving and prolonging of life — an activity in which today each household is expected to participate.

This instance should serve as an inspiration to us all, for there is still a mine of statistical wealth to be exploited for human welfare. Time and circumstance have contributed to the improvement of the quality of data recorded and the development of suitable methodology for their interpretation. Individuals belonging to various disciplines, medical men, mathematicians, sociologists, economists, take part in this, but a more significant contribution is called for from individuals who have the primary responsibility of assembling reliable information. The field of health statistics is open to all.

[1] Natural and Political Observations made upon the Bills of Mortality, by John Graunt. London, 1662. Edited with an Introduction by Walter F. Willcox. The Johns Hopkins Press, 1939, Baltimore, Md.

CHAPTER 2

What Basic Data to Collect

2.1 The statistician's tasks

In determining the kinds of statistical information needed in the work of a health agency, the statistician should be guided by one paramount consideration, namely how, as an active member of the public health team he can be of the greatest value and service to the health agency and especially to the chief health administrator. Dr. Clarence Velz[1] has visualized this close day-to-day relationship between the health administrator and the statistician in planning, executing and evaluating health programmes as follows: "Thus one sees the public health team venturing forward led by a courageous and imaginative administrator with the public health statistician at his side, sounding, probing, testing, sifting, evaluating."

The tributes[2] paid by health administrators to statisticians who had worked in the health agencies show how they were able to anticipate the data needs and were ever prepared to meet urgent as well as routine day-to-day demands of the other members of the health team.

2.2 Sources of health statistics

The various sources of information, some of which are discussed in greater detail in the chapters that follow, can be classified into categories:

2.2.1 Systems organized on a national scale to obtain information continuously from each household or institution, that is, registration and notification of disease. In recent years national estimates of total morbidity have been obtained through nationwide surveys on a sampling basis. Similar surveys have given estimates of the prevalence of certain diseases of long duration, e.g. tuberculosis, cancer, and leprosy.

2.2.2 Medical and health institutions providing service to the community, such as hospitals, clinics, and dispensaries, maternal and child health centres, local health units, diagnostic laboratories, mass immunization or treatment programmes, social security schemes, medical care programmes,

[1] Vistas in Public Health Statistics, by Clarence F. Velz. Public Health Reports, Volume 67, No. 8, August 1952.

[2] See for instance: (1) W. Thurber Fales, Chief Statistician and Philosopher-Guide. Baltimore City Health Department 1934-53, by Huntington Williams and Matthew Tayback. Baltimore Health News, Vol. XXXIII, No. 9, September 1956. (2) The role of the Vital Statistician in the Community as evolved by W. Thurber Fales, by Lowell J. Reed, American Journal of Public Health, Vol. 45, No. 1, January 1955, pp. 11-20. (3) Guessing and Knowing—What makes the difference? A tribute to a statistician—Hilde Freeman Silverman, by James E. Perkins. American Journal of Public Health, Vol. 47, No. 9, September 1957, pp. 1053-1064.

and the like. These provide statistics of admissions to hospitals and other medical institutions or services, and diagnostic returns of diseases for which treatment was provided, their duration and outcome. The data generally relate to selected population groups.

2.2.3 Surveys or investigations conducted in response to the need for more detailed information on a narrower geographic basis such as nutrition surveys, epidemiological investigations in various diseases, field trials to test the therapeutic or prophylactic value of drugs, vaccines, or procedures.

2.2.4 Miscellaneous, e.g. physician case records, police reports on accidents, meteorological data and information on social, economic or occupational factors affecting health.

2.3 Utilization of the basic data

From the sources mentioned in the first two categories statistical information of value in health work is derived generally as a by-product.

From the point of view of usefulness of information the available statistics fall into three categories, relating to:

2.3.1 health status of persons and populations in a given area, providing us with indices of vitality and health,

2.3.2 the physical, environmental and other conditions and factors having a more or less direct bearing on the health status of the population — indices of social and environmental factors,

2.3.3 health services and activities directed at the improvement of health conditions — indices of health activity and facilities.

Some of these data are collected in accordance with established legal provisions; others in response to specific needs of the health agency and its stage of development. Some are required because they are largely of local concern, others because the health agencies at higher levels — state, national, and international — are also interested. Some are needed to promote health plans, some to ensure their effective execution, others for the evaluation of health work. The utilization of data in a health agency has been described in detail by Ruth Puffer in her book "Practical Statistics in Health and Medical Work".

2.4 Definition of vital and health statistics

In recent years the term "vital statistics" has been used to denote "facts systematically collected and compiled in numerical form relating to or derived from records of vital events, namely live birth, death, foetal death, marriage, divorce, adoption, legitimation, recognition, annulment, or legal separation.[1] These events may be required to be permanently registered with authorized offices for legal and documentary purposes as well as to provide national statistical data. In essence, vital statistics are derived from legally registrable events without including population data or morbidity statistics.

[1] Principles for a Vital Statistics System. Recommendations for the Improvement and Standardization of Vital Statistics. Statistical Papers, Series M, No. 19. Statistical Office of the UN, New York, August 1953.

No definition of the term "health statistics" has yet been agreed. In general, the term should include all statistical information required for the administration of a health agency, and so would comprise not only vital statistics but also a good deal of other numerical information. More usually the term is limited to health data other than the term "vital" statistics. Recently, a comprehensive concept of this term has been set out by Italian writers Dr. Giovanni L'Eltore and his colleagues.[1]

2.5 Records for a local health unit

Dealing specifically with a local health unit — the nucleus of the rural health service, under the direct supervision of at least one physician — the WHO Expert Committee on Public Health Administration[2] briefly outlined the maintenance of the following simple records:

2.5.1 *Population records*

These include the number of inhabitants, grouped by locality, and individual records indicating age, sex, ethnic origin, and marriage. Other data which provide information about the community should also be kept, e.g. housing, water-supply, and methods of disposal of waste; educational facilities and the extent of illiteracy; and general economic, agricultural, and industrial conditions. Some of these data might be obtained from national census bureaux, but should be checked and completed by the local survey.

2.5.2 *Birth records*

These include individual records of live births and foetal deaths.

2.5.3 *Mortality records*

Individual records of deaths indicating the dates and causes should be kept for the compilation of the rates on general mortality, infant and neonatal mortality, specific mortality due to communicable diseases, mortality from certain chronic diseases such as cancer, diabetes, and heart disease, and the ten main causes of death. Efforts should be made to have death certificates recorded by a doctor, and they should be adjusted to the International Statistical Classification.[3] The data should be classified and analyzed monthly and annually. In areas where there is a local office of civil registry recording the births, deaths, marriages, and movements of the population, the work of the registry should be co-ordinated with the local health unit.

2.5.4 *Morbidity records*

These include records for communicable diseases and important chronic conditions such as cancer, diabetes, and heart disease. In addition to the information derived from the working records of the health unit, the

[1] Statistica e Sociologia Sanitaria. Lezioni e Studi di Giovanni L'Eltore, E. Caranti, O. Ceino, V. Marchiano, V. Rustichelli. IIa Edizione, Rome, 1956.

[2] Methodology of Planning an Integrated Health Programme for Rural Areas. Second Report of the Expert Committee on Public Health Administration. World Health Organization. Technical Report Series No. 83, 1954.

[3] Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death, Seventh Edition, Vols 1 and 2, World Health Organization, Geneva, 1957.

reports of these diseases from private doctors, hospitals, clinics, and other sources should be brought together for the compilation of morbidity reports.

2.5.5 *Reporting*

The occurrence of the six "quarantinable diseases" (smallpox, cholera, plague, yellow fever, typhus, and relapsing fever) should be reported immediately by telegraph or telephone to the higher authorities. Weekly reporting of communicable diseases and a narrative and statistical monthly report of the activities carried out by the unit in its different sections may be necessary.

2.5.6 *Statistical investigation*

Special statistical investigation work on tuberculosis, venereal disease, malaria, leprosy, goitre, etc., would be carried out at the intermediate level, where more extensive facilities are available; this also applies to analysis of the endemic indices established by certain State services.

2.6 National health statistics

The extent to which health statistics for rural and urban areas are produced depends largely on the public health services for the area. On the other hand, in some places vital statistics may be obtained even though adequate public health facilities do not exist.

The statistics that are generally produced on a national basis are the census data, vital statistics, and statistics of notifiable diseases. Other health statistics are those collected by hospitals, dispensaries, clinics, school health services, or through surveys which, although not covering the entire country, can yet provide valuable information on a sampling basis. Generalizations from these figures should be made with care.

2.7 Mechanism for the collection of health statistics

It has been estimated by the United Nations that for at least 40 per cent of the world's population no satisfactory procedure has yet been established for reporting and registering vital statistics on a countrywide basis. Many of the less advanced countries fall in this category. For large masses of population, therefore, vital and health statistics are either non-existent or very incomplete. For instance, in several territories the collection is limited to centres served by medical institutions in urban areas.

In countries where the machinery for the collection of statistics for rural areas has been set up, the village is generally the smallest administrative unit for which an agent is appointed to report the events, and in some cases he may also be responsible for registering them. The responsibility for registration in rural areas generally rests with the head of the household in the developed countries. In rural areas of countries like Burma, Egypt, India, Pakistan, the head of the household is not obliged to make a report. The primary responsibility for each village may rest with the village headman, the police officer, village watchman or revenue officer. Sometimes one of the local inhabitants is appointed registrar of vital statistics, whose duty is not only

to keep himself informed about all vital events occurring in the area, but also to be the custodian of legal records.

The primary duty to collect statistics may lie with one department, and that of consolidation, analysis and publication, with others. Thus departments of police, revenue, local government, justice, home affairs, and health, may all be part of the legal machinery. When matters relating to the health of the people are concerned, liaison between the health department and other participating departments usually exists. Among the devices which have been suggested to strengthen this is to establish in each country a National Committee on Vital and Health Statistics (see Chapter 8).

2.8 Procedure for reporting and registration

Regulations for reporting and registering vital events differ from one country to another.[1] Generally, in the advanced countries the registration takes place in the village or small rural community. In several countries a single registration office may cover a large group of 50 to 100 villages, and the reporting agent in each village is provided with handbooks in which particulars regarding births and deaths are separately recorded according to the date of occurrence. At periodic intervals — a week or a fortnight — these booklets are taken to the registration office (police office, health department or the revenue), where permanent registers with legal authority are maintained. At periodic intervals also, summaries of total births, deaths, etc. are forwarded to the National Vital Statistics Office for compilation. The identity of individuals is not disclosed and only total figures in each group are reported.

So far as registration of vital events is concerned, accuracy rather than speed is important, and a delay of even a month may occur before events are notified to the central statistical offices. On the other hand, in reports on the outbreak of infectious diseases, the primary consideration is speed, and arrangements are made to transmit immediate information to the appropriate local health authorities for action. In many cases daily reports are required. Health departments make arrangements for information from rural areas to be sent by special messengers, telephone or telegraph according to urgency. The collaboration of school-teachers, postal authorities, and other visiting staff has also been enlisted.

2.9 Defects in health statistics

Health statistics suffer from both quantitative and qualitative defects. Quantitatively, there may be omissions resulting from the negligence of reporting agencies in discharging their functions, lack of co-operation between individual households and the reporting or registering agencies, or even a temporary breakdown of the system from absence of staff. Omissions may increase during times of flood, famine, wars, epidemics, or other catastrophes, dislocating normal ways of life. Not uncommonly, reports from

[1] Handbook of Vital Statistics Methods. United Nations Studies in Methods, Series F, No. 7, Statistical Office of the UN, New York, 1955.

individual villages or groups of villages may remain unregistered for long periods. The extent of omissions may vary from year to year, sometimes leading to false trends in vital statistics. Other reasons for incomplete reporting are that:

(a) no legal provision may exist for making registration compulsory or notification obligatory; even when a law exists its enforcement may be perfunctory; defaulters may escape without adequate cautioning or punishment;
(b) registration officials and reporting agents may be overburdened with other duties, and so lack interest in statistical work;
(c) co-operation between health department officials and the medical practitioners in rural areas may not be close enough;
(d) the purpose of registration or disease notification may not be properly appreciated by uninformed rural populations, especially when health activity on a mass scale, such as compulsory immunization or isolation of infectious cases, is enforced tactlessly, so that the people become suspicious of the motives of government officials;
(e) poor or interrupted means of postal and other communications during certain seasons or periods may make reporting impossible;
(f) want of supervision or proper training of the staff at various levels may result not only in omissions but also in errors in copying, posting and compilation of figures.

Qualitative defects arise largely because of the shortage of qualified medical practitioners and health workers in many areas, more especially in the rural parts. It is true that because of the rather intimate social life in small communities, the death of an individual in a rural area may be seen by a large number of persons, and that a few common diseases and causes of death may be recorded with fair accuracy. All the same, lack of diagnostic facilities over large areas of the world means that the nature of diseases and causes of death will usually not be accurately known, (see Section 13.2.7).

2.10 Suggestions for improving health statistics

In addition to the steps taken by national governments and international agencies to improve national health statistics, a good deal can be done by local or individual effort. One of the important steps towards ensuring proper coverage and completeness is to maintain permanently a list of households in each small community. A house list is usually prepared for each locality at the time of the census, but in many cases it is not kept up-to-date. This list would help the health staff in organizing their activities, like insecticide-spraying, immunization, domiciliary services, or in carrying out sampling surveys. The lists should be constantly checked by the health staff visiting the locality.

Another important step to stimulate the collection is to provide incentives to the people to register events. Among uninformed people it is not unlikely that the law requiring the registration of vital events or reporting of disease may be misinterpreted as something relating to the raising of taxes, con-

scription, compulsory isolation, etc. On the other hand, if people, especially those in rural areas, are led to believe that these reports are valuable to each individual in establishing identity, citizenship, date of birth or death in connexion with recruitment to various services, as well as for the protection of their health, they will be disposed to comply with the law in their own interest. The education of the people in the uses of statistics could be undertaken by all categories of public health workers.

Individuals who enjoy prestige in the locality (priests, teachers, etc.) should be asked to help. Their local knowledge and status should result in the recording of events which might otherwise escape notice, and at the same time they should be able to awaken in the people a sense of personal responsibility for human book-keeping.

The provision of a registration office, easily accessible to every segment of the population and a clear demarcation of the area to be covered by that office is the first step to securing complete registration or reporting. The correct registration of causes of death will take time, and will depend on an adequate supply of qualified medical practitioners in every community.

Like any other machinery, the "national machinery for the collection of health statistics" has its component parts which must work smoothly and on time, and with enough power to make it go.

This national machinery derives its "power" from legal enactments or executive orders. If the necessary regulations do not exist or are not enforced, then the machine cannot function. If any link is missing in the chain of operations, breakdowns occur, leading to gaps in information. The "motive" is the use for which the data are collected. Imperfect use or lack of understanding of the uses of health statistics inevitably leads to inefficient working.

No shortcut can be devised for improving national health statistics, but each category of health staff has its part to play. There is no doubt that slow, steady progress is already being made, but much can be done in selected areas to raise the level of both quality and quantity of material. The institution of new health measures will lead to a corresponding improvement in statistics only if proper regard is paid to collection by the health staff working in those areas and to the education of the local population in their responsibilities and legal obligations so as to enlist their co-operation. A health statistician should make a careful study of the system of collection as it has already developed in a community, discuss plans for improvement with local authorities, enlist their goodwill and then set up a sound machinery for collection, so that reliable basic figures are obtained before any new health projects are launched. The important point is that items of information have to be picked up individually from each home. The task of the health statistician is in this respect a much more difficult one than in other fields. For instance, in dealing with industrial statistics one could locate the few industrial centres and under legal penalty ask for the required information to be supplied, or arrange to visit those relatively few places to ensure accuracy and completeness of the information. Similarly, education statistics may be collected from schools, universities or other teaching institutions. For trade

statistics one could set up collection points at ports or roads of entry into a country. But in health statistics one must take into consideration each individual household and ensure that the entire population responds to the needs and goes on responding all the time. With the limited legal powers and resources at his disposal, it is not an easy task for the health statistician to ensure full community participation. In many parts of the world such systems have been established and are gradually being improved, but there are still vast areas where a system exists in name only, if at all. The greater the development in health services, the greater is the need for more detailed and more accurate accounting.

CHAPTER 3

The Population Census

3.1 Need for population census

The total process of collecting, compiling and publishing demographic, economic and social data pertaining, at a specified time or times, to all persons in a country or delimited territory is called a population census.[1] This operation has a long history. The main object of counting the people in ancient days was to know the number who could be recruited to the army or the labour force or to find out the amount of tax which could be collected. As time passed, the scope of the census widened and more items were added to the list of information. In the decade from 1945 to 1954 individual data on more than 2,000,000,000 people were collected by means of population censuses.

Today, the connexion between the census and taxation or military service is no longer emphasized. On the other hand, the purpose of a population census is primarily to satisfy certain national needs for statistical information. The census is now an operation of great value to each country and the census data are utilized in a number of ways for planning the welfare of the people. For example, to ascertain the total food requirements of the country the government needs to know the number of people. In planning social welfare schemes relating to schools, hospitals, houses, orphanages, widows' or old persons' homes, pensions, etc., figures of the population by age or sex and changing urban-rural concentrations are necessary. For calculating indices such as death rates, birth rates, and sickness rates, it is necessary to know the population distribution by area, age and sex. In fact, health departments are one of the principal consumers of census data. They should understand their need for a good national census, and how to make use of the data. Further, the census authority should consult the health department before planning a census, and the health authority should be prepared to make recommendations as to the content of the census schedule, tabulation, delimitation of areas, etc. The census authority may also be required to prepare special tables and duplicate cards for use in health departments.

3.2 Characteristics of the census

A census, as developed at the present time, means an operation which satisfies the following characteristics:

[1] Principles and Recommendations for National Population Censuses. UN Statistical Papers, Series M No. 27. New York, 1958. See also Handbook of Population Census Methods, UN Statistical Series F No. 5 (Rev. 1) in three volumes.

(a) It should include every individual in the area without omission or duplication.
(b) The information should relate to a well-defined point of time; international simultaneity is desirable.
(c) It should be taken at regular intervals, usually every ten years. In some countries, a census is taken every five years.
(d) It should refer to people inhabiting a well-defined territory. If there is a change of territory from one census to another, it should be indicated, and figures must be given for each territory separately.
(e) Because this elaborate operation covers the whole population, it is usually the responsibility of the central or federal government, preferably with the co-operation of provincial and local authorities.
(f) In order to maintain a high degree of reliability it is desirable that the information collected at each census be obtained from personal contact, i.e., by house-to-house visits. Even though it is not practicable to make contact with every person in a family, at least one responsible member of a family should be interviewed.
(g) In most countries the personal data collected in a census are not used for other than statistical purposes.
(h) The compilation and publication of data by geographic areas and by basic demographic variables is an integral part of a census.

A population census is a difficult operation. The way in which it is planned, organized and conducted is therefore of great importance. The taking of a census can be compared with the construction of a building: there must be a proper plan.

3.3 Planning of a census

The method suitable for any country will depend on existing conditions. For example, in a country where the majority of the people are illiterate, information cannot be supplied by the individual in written form. It must be collected and entered on the schedule by a census official appointed for a specified area. This is the *canvasser* method. In some advanced countries the head of the household may be entrusted with filling up the form on behalf of the individuals in a family (the *householder* method). The enumerator leaves the schedule with the head of the household and then collects the completed schedule on the specified date of the census. His duty is then to see that the schedule is complete.

In planning a census a number of special features have to be taken into account. The statistical tables have to be designed, as also the method of processing the data. The early steps include the design of the schedule, selection of the data to be collected, and the organization of field work. The preparations at the central office cover publicity work, the training programme and the study of the aims to be achieved. The time for taking the census has to be fixed, and a budget prepared to cover expenses.

The establishment of a legal basis for taking the census is essential. One of the requirements for a successful census of population is to make it

compulsory for every person to give the information required to the appointed enumerators. Other details of legal steps to be taken by the government to form a basis for confident co-operation of the public, are:

(a) a clear statement by the government about the nature of the census; and

(b) a guarantee by the government that the information collected will be confidential so far as individuals are concerned, and used only for statistical purposes.

3.4 Scope of a census

When planning a census the aims must be decided. The resources, needs and conditions of a country, together with international recommendations will determine its scope. In some countries censuses of housing, agriculture and industries may be taken, along with that of the population.

In making a budget it is necessary fo find out details and costs of various operations. The rate at which people engaged in different operations will be able to turn out work may sometimes be estimated by a trial census on a small scale.

3.5 Preparation of a census schedule

The census schedule has to be prepared with great care, keeping in mind the ultimate tabulations required. The questions included in it must be simple, free from ambiguity and so clearcut that answers can be obtained without difficulty. Three types of schedule may be used. One is the individual schedule, in which information relating to each person is filled in on a separate form. This would be advantageous when a large number of items of information per person are taken. An alternative form is the household schedule on which information relating to all members of a household is collected. When information relating to the households also has to be tabulated, this form would be suitable. A third type, the collective schedule, is one in which the information relating to more than one household or relating to all members of an institution is taken down. The collective schedule has advantages in economy in printing and is suitable for mechanical tabulation with individuals or households as the unit.

3.6 Publicity for the census

The success of a census largely depends on the interest and co-operation of the people enumerated. This in turn depends on the publicity given to the aims and objects of the census so as to dissipate anxiety about its purposes and explain the reasons for the various questions on the schedule. To get the full co-operation of the people, everyone must know that the information collected about individuals will be kept strictly confidential.

3.7 Enumerator training

The quality of work done by the enumerator — the person who interviews the people and collects information — will to a great extent decide the accu-

racy of the figures published in the census report. The enumerators should know their job fully, and understand the meaning of the different terms used in the schedule. They should receive thorough training in filling up the schedule before they are sent out to the field to do the actual enumeration. The method of asking the various questions so that people give the correct answers is an important part of their training. A trial census on a small scale is undertaken to give the enumerators the necessary experience in carrying out the actual census.

3.8 Methods for improving the accuracy of information collected at the census

There must be an adequate number of supervisory staff to check the work of the enumerators. The completed questionnaires must be checked for accuracy and completeness of information. Methods should be devised to estimate the extent of error due to omission. Testing various aspects of a census plan before the enumeration is a necessary practice because it shows whether the field organization is sufficient. It also demonstrates any faults in the training programme, and weaknesses in the schedule, instructions, or enumeration procedures.

3.9 Compilation and tabulation

In a number of countries machines are used for compiling and preparing tables for the census, but in others compilation is done by hand. While hand processing can never be as accurate or yield as much information as machine processing, the simpler basic aims of a census can be met by hand labour if adequately organized and supervised. It is important that drafts of the final tables should be made at an early stage. The schedules must be designed so as to facilitate sorting and tabulation of data. Care is needed to build tests of internal consistency into the processing scheme.

3.10 Publication of the results

In many countries, because of the inevitable delay in the publication of the final results of the census, a preliminary set of figures is issued. Sometimes a preliminary report is published on the basis of a 1% or 10% sample of the census returns. There ought not to be delay in publishing the final results of a census, because results after 5 or 10 years lose much of their usefulness. The final publication must give details of the results of the count, and also comments on the figures, a discussion of the methods used, and a copy of the schedule.

3.11 Recommended subjects for inclusion in a population census

3.11.1 *Total population*

There are two ways of counting the population. One is enumeration on a *de facto* basis, i.e. counting all persons in the area where they are present on the date of the census. In other censuses a *de jure* count is made, the population of each area being defined as persons who usually reside in the area,

regardless of their actual location on the census date. Various combinations or modifications of these two concepts are also used depending upon national needs and the enumeration plan followed.

In connexion with the 1960 World Population Census Programme, the United Nations consider it desirable that "where consonant with the type of census taken, and in addition to any other total computed for national purposes, each country compile the total number of persons present in the country at the time of the census, *excluding* foreign military, naval and diplomatic personnel and their families located in the country but *including* military, naval and diplomatic personnel of the country and their families located abroad and merchant seamen resident in the country but at sea at the time of the census." This is neither a *de facto* nor a *de jure* population, but provides the information needed for international comparisons and for regional and world totals. For convenience, this figure, which may also be the desirable total for national purposes, may be referred to as the "international conventional total".

3.11.2 *Sex*

This is one of the simplest items included in a census enumeration. Large differences between the number of males and females affect marriage rates and population growth.

3.11.3 *Age*

A knowledge of the age structure of the population is important from many points of view. For instance, it is needed for the calculation of vital rates and for forecasting population trends. It indicates whether the population contains sufficient numbers of people to provide for various administrative, labour and other economic pursuits. Information on age is obtained in two ways, by asking either the date of birth of the person or the age at the last birthday. The second method is generally considered less accurate than the first because it more easily permits approximate replies. In areas where it is not possible to obtain the ages of the persons enumerated, a rough age differentiation is provided by using the groups stated in Section 13.5.

3.11.4 *Marital status*

Information on the marital status is of social and economic importance. Usually, it is classified under four headings: (a) single, (b) married, (c) widowed (not remarried), and (d) divorced or separated (not remarried). See Section 13.6.

3.11.5 *Educational characteristics*

This information is necessary to assess the rate of progress in providing adequate education and is collected by asking questions on literacy or level of education or school attendance.

For census purposes, literacy is defined as "the ability both to read with understanding and to write a short statement on everyday life in any lang-

uage." A person capable of reading only, or reading and writing figures and his own name only, should be considered illiterate. Data on literacy are collected for all persons fifteen years of age and over. In addition to questions on literacy (which are unimportant for most of the advanced countries, where the percentage of illiteracy is negligible), many countries ask about the highest level of instruction completed in the country's regular educational system. Alternatively the total number of years of schooling may be asked for as a substitute.

3.11.6 *Economic characteristics*

These show in the population the economically active age groups classified according to economic activity, occupation, industry, and employment status (employee or employer etc.) The measurement of the labour force, the amount of unemployment and so on, are the chief items obtained under this heading. The data are tabulated separately for persons under fifteen years of age, and persons fifteen years of age and over, (see also Section 13.7).

3.11.7 *Place of birth*

Information on immigration as well as internal migration can be obtained from this item. Statistics on the age and sex distribution of the native-born population compared with the foreign-born population will be of use in studying the effect of immigration on the labour force of the country.

3.11.8 *Language*

Several types of information on languages have been obtained in the population censuses. They are (a) mother tongue, (b) usual language or languages currently used by the person, and (c) ability to speak one or more specified languages.

3.11.9 *Fertility data*

Where feasible, information is collected from all women, regardless of marital status, about all children born alive up to the census date (i.e. excluding stillbirths or foetal deaths). All liveborn children are included whether legitimate or illegitimate, and whether born of the present or of previous marriages.

If the woman's age and marital status are studied along with the total number of live births it is possible to estimate fertility in different age groups. If the numbers of years a woman has been married is also considered, it is possible to study the fertility in relation to the duration of marriage.

3.11.10 *Citizenship (nationality)*

This item will enable one to know the number of foreign nationals living in the country.

3.11.11 *Urban and rural populations*

There is no internationally agreed definition for classifying an area as

urban or rural. Criteria used for designating an area as urban are density of population, the system of administration and occasionally the number of people living in the area. Realising the difficulty of giving a standard definition for an urban area, the United Nations has recommended for international purposes the classification of population by size of the locality[1], e.g., places having populations of 500,000 or more, or 100,000 to 499,999; 50,000 to 99,999; 20,000 to 49,999; 10,000 to 19,999; 5,000 to 9,999; 2,000 to 4,999; 1,000 to 1,999; 500 to 999; 200 to 499, and population in localities of less than 200 inhabitants.

3.12 Estimation of intercensal and postcensal populations

To understand clearly the significance of the vital events of a population such as births, deaths and diseases, one must know the number of persons comprising the population. As a census is generally carried out only at 10-year intervals, the size of the population has to be estimated for both intercensal years and for the years following the latest census. A number of methods are available, the most suitable for an area depending on various factors, (see Section 15.2).

3.13 Information derived from the census

Some of the outstanding features of census information lend themselves very well to diagrammatic representation by means of maps and charts. These visual images present the picture as a whole and so impress the reader with a sense of unity. Among these features the density of population is particularly striking because of the contrast which it shows (see Fig. 3.13a). Other diagrams (3.13b, c, and d) show striking historical changes. Others (Fig. 3.13e) show various distributions such as by age and sex. The sharp contrasts between countries already fully industrialized and those on the threshold of mechanization are thus brought out. These diagrams are a vivid illustration of the more important demographic characteristics and changes.

[1] "The term 'locality' is defined as a distinct and indivisible population cluster (also designated as agglomeration, inhabited place, populated centre, settlement, etc.) of any size, having a name or locally recognized status and functioning as an integrated social entity. This definition embraces population clusters of all sizes, with or without legal status, including fishing hamlets, mining camps, ranches, farms, market towns, communes, villages, towns, cities and many others." UN Principles and Recommendations for National Population Censuses. Statistical Papers Series M, No. 27, p.11, 1958.

WORLD POPULATION DISTRIBUTION 1955

(1 dot represents 1 million inhabitants)

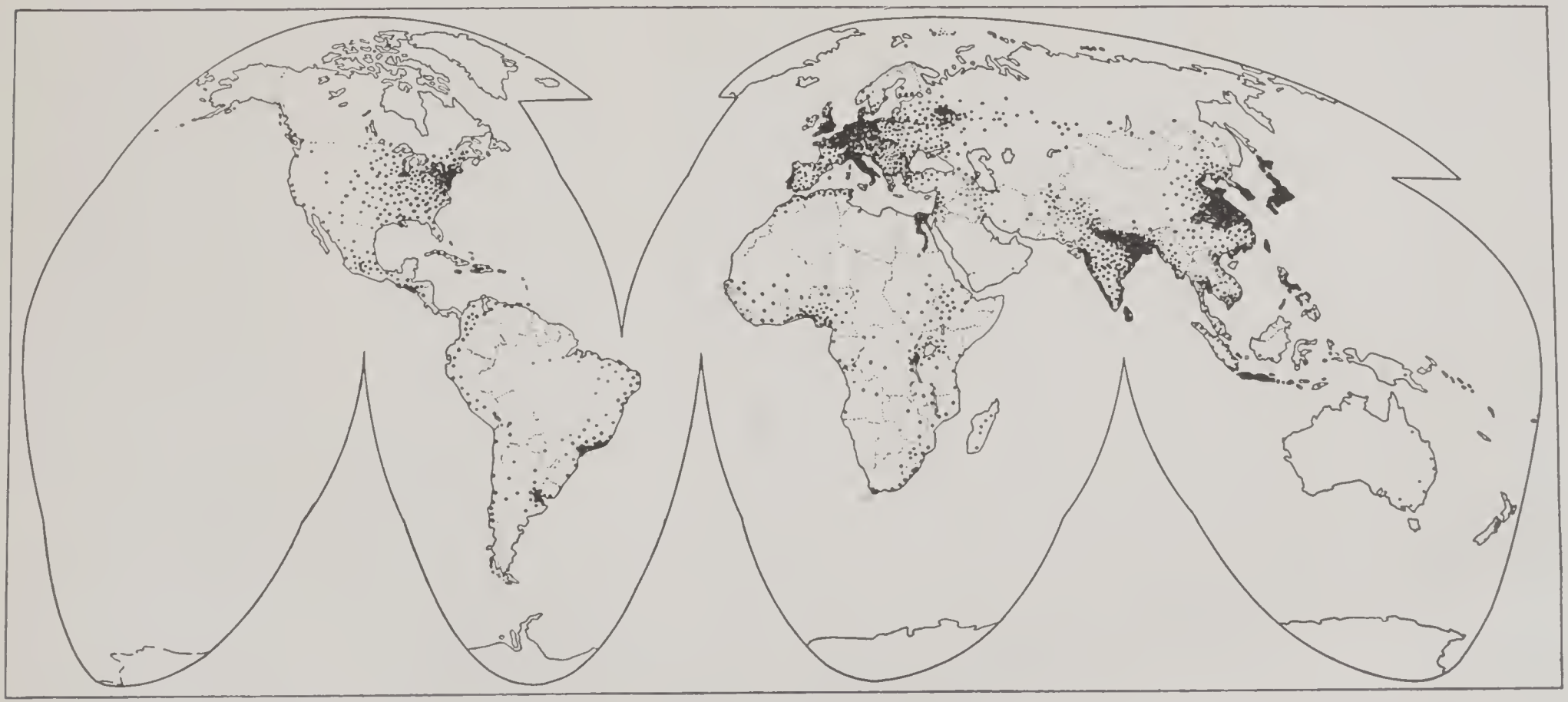


Fig. 3.13a

AVERAGE ANNUAL RATES OF POPULATION INCREASE
THROUGH MIGRATION AND NATURAL INCREASE
1850-1900 and 1950-56

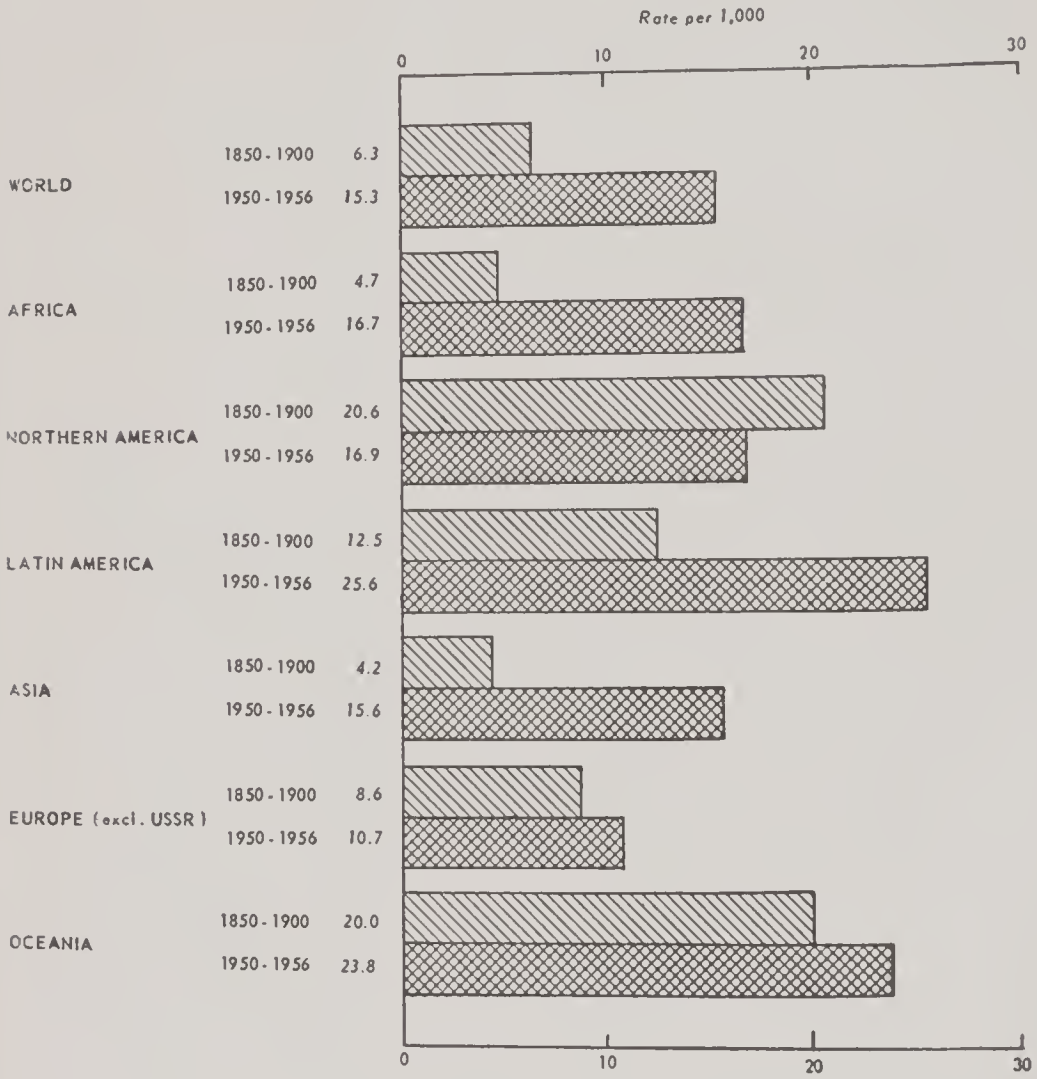


Fig. 3.13b

POPULATIONS FOR REGIONS OF THE WORLD
1650-1949

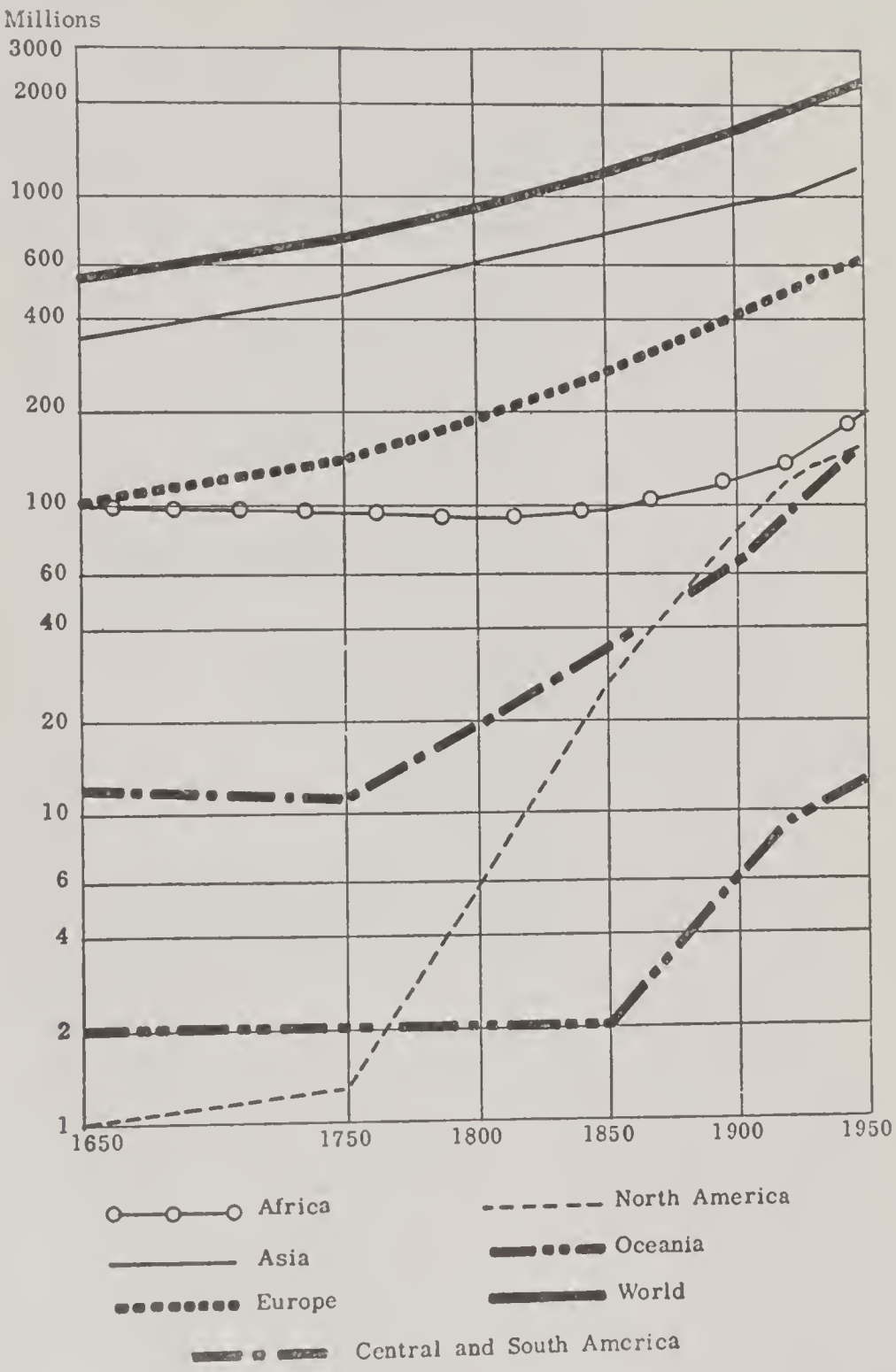


Fig. 3.13c

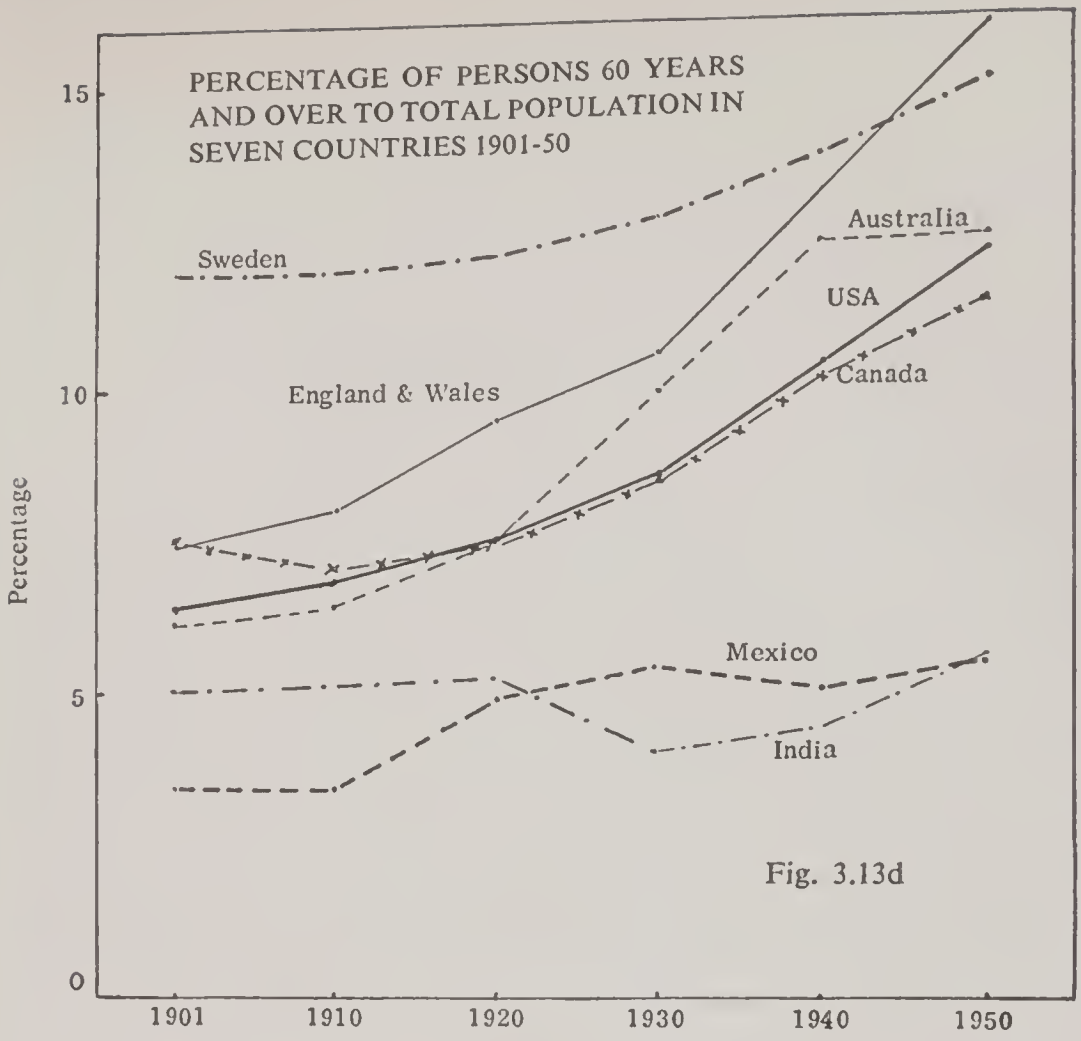


Fig. 3.13d

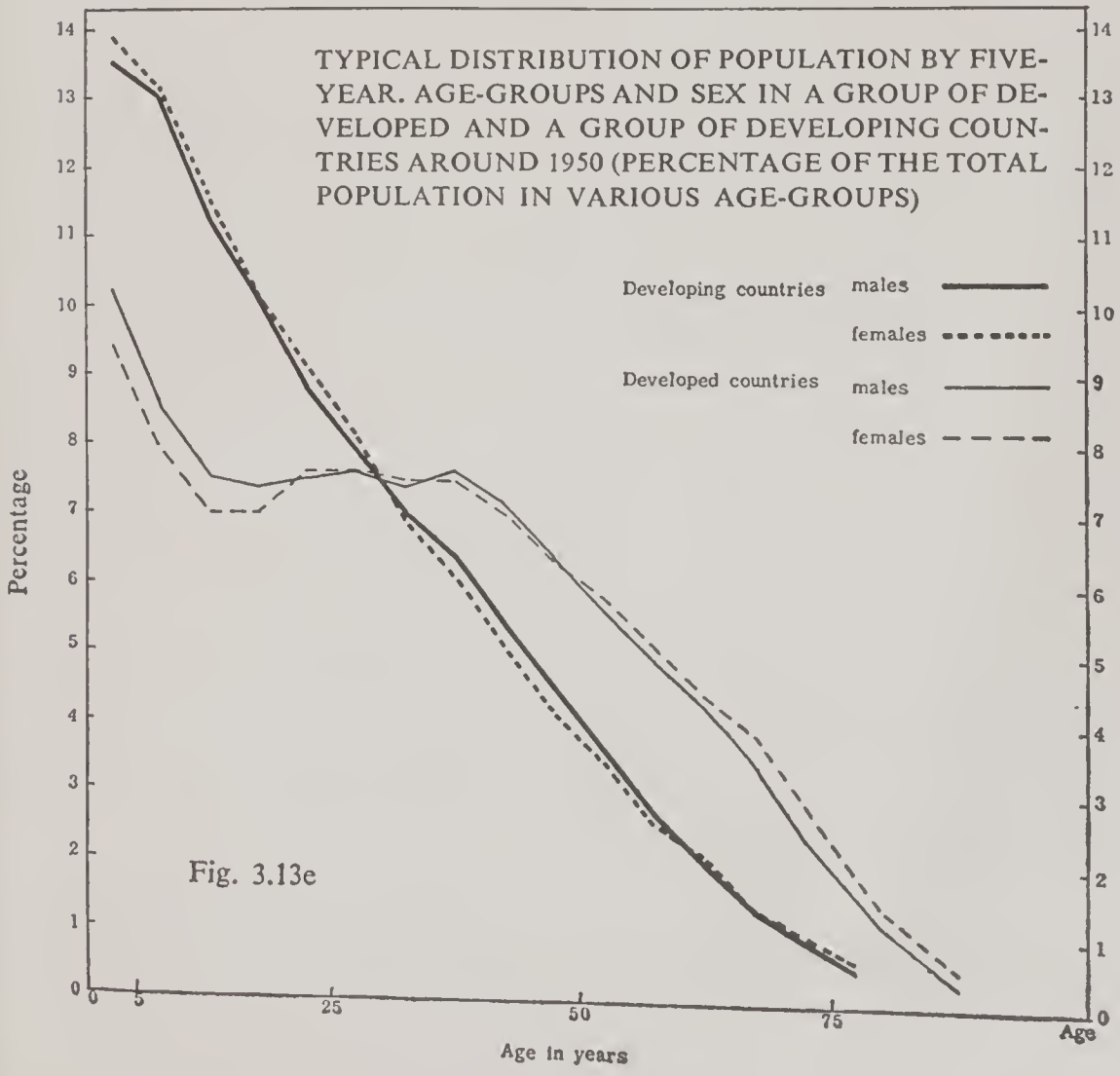


Fig. 3.13e

CHAPTER 4

Vital Statistics

4.1 Introduction

Changes in population numbers are taking place every day. Additions are made by births or through new arrivals from outside the area. Reductions take place because of deaths, or through people leaving the area. The number of persons immigrating or emigrating can generally be determined from records maintained at the places of entry. But, in order to understand what changes occur in population numbers and structure, it is essential, in addition, to know correctly the numbers of births, deaths, marriages, etc. In many parts of the world governments have set up organizations for this purpose. The taking of a census is merely a snapshot of an event. On the other hand, the counting of births and deaths is a continuous process, like taking a cinematograph film which follows movements in the population without pause.

4.2 History of vital registration

The story of recording births and deaths is very old. The need for recording these events was recognized as early as 1250 BC in Egypt where a rather elaborate birth and death registration system was set up in the reign of King Rameses II. Some centuries later the citizens of Rome were required to register births and deaths, and officials were appointed throughout the provinces to record the relevant facts. These early beginnings seem to have been in the form of a population register of which vital records were an integral part. The records were presumably used primarily for public administrative purposes such as taxation, labour and military conscription.

Beginning in the 15th Century, churches in some countries started to keep records of baptisms, marriages and burials of their members. The recording of baptisms and burials was to provide information on admissions to the church, and death of members, and to maintain an account of payment for participation by the clergy in the baptismal and burial rites. Also, these records served to furnish evidence of kinship which provided a means for enforcing that portion of the ecclesiastical law that forbade marriage of relatives. It was a relatively simple matter for the mediaeval church to keep these records since it performed all the baptismal and marriage ceremonies and maintained the burial grounds.

The recording of births, marriages and deaths was later extended from church members to the community, and became a civil rather than a purely clerical function. However, in some countries such as Sweden and Finland,

the function of registration remained in the hands of the clergy although the system is one of civil administration. Derived from these records, Sweden and Finland possess today an unbroken series of vital statistics indices as far back as 1749 A.D., (see Table I), although compulsory national civil registration was legally established earlier, in 1686.

Records of ecclesiastical registration were also maintained in France, Spain, England and Ireland. From the 17th Century, the various countries of Europe began to adopt laws making registration of live births, stillbirths, deaths and marriages compulsory. This continued through the 18th and 19th Centuries. About the middle of the 19th Century a number of countries in the American continent, Australia, New Zealand and a few Asiatic countries began compulsory registration of vital events. The present century saw countries in the African continent included in the list of areas with compulsory vital registration.

A chronology of important steps in the progress of civil registration of vital events has recently been issued by the Statistical Office of the United Nations.[1] The main events that concern vital statistics, beginning in the year 1250 B.C. have all been listed.

As mentioned earlier, the first use of these records in modern history was probably made by the clergy. Today of course, these records are being used by health and other agencies of governments and other interested people in many different ways. The one person who led the way in pointing out the wealth of information that lies in records was John Graunt, who has already been mentioned (Section 1.10). An analytical study enabled him to demonstrate successfully four of the most important facts which vital statistics disclosed. First he made clear that there was a certain regularity in the occurrence of these phenomena which considered independently may appear to be merely the play of chance. Secondly, he pointed out that there was always an excess of male births over female births but that in the population alive at any time, the number of the two sexes was approximately equal. Thirdly, he showed that the mortality rate was relatively high in the earliest years of life, and finally he found that the death rate in cities was then higher than in rural areas.

This publication by Graunt attracted many other workers to carry out further investigations in the same field, such as Huygens in Holland and Halley in England. Another personality who contributed greatly to the early development of vital statistics was Dr. William Farr who in 1839 was appointed the first "compiler of abstracts", a post which corresponded to statistician in the General Register Office of England and Wales. To Farr should be given the credit for starting a series of mortality statistics and the publication of their analysis. He served in that office for about 40 years and greatly enriched the subject of vital statistics. At present a large number of workers are engaged in the worldwide work of reporting, registering and

[1] See Annex 1, pp. 213-216 of Handbook of Vital Statistics Methods. Studies in Methods, Series F. No. 9, Statistical Office of the United Nations, 1955, New York.

counting births, deaths and other vital events. Some — the reporting agents — transmit reports of vital events to a designated authority engaged in registration, i.e. "the continuous and permanent, compulsory recording of the occurrence and the characteristics of vital events primarily for their value as legal documents and secondarily for their usefulness as a source of statistics". Thus, the registration record, "the legal document which attests to the occurrence and to certain characteristics of a vital event" is established. Others are employed in the process of compilation, i.e. "condensation of information by classifying and tabulating statistical reports in various categories or classes with the object of producing vital statistics according to a predetermined programme". The next step is consolidation, "the process of combining into one aggregate statistics compiled by different agents". Still others are engaged in presentation, i.e. making statistics available through publication or other means of dissemination among consumers, usually in the form of published documents. For a correct understanding of the operation of this system in any area or country one should first study the historical development of the vital statistics system of the area, examine what further legal provision should be made to ensure the smooth collection of this information, what staff should be utilized, what should be the duties of each category of staff in connexion with the transmission of the information, recording it, summarizing it in the form of tables, analysing, presenting and making it available in proper form to the people directly concerned and interested in it. One should also give thought to what should be the design of the forms on which the information is collected, how to ensure accuracy and completeness in recording the information and to the need for carrying out checks on reliability and efficiency from time to time.

Willcox estimated that in 1833 births and deaths were being registered for about one-tenth of the world's population; in 1933 registration laws covered about one-half of world population. In 1955 the registration coverage of births and deaths was about 60 per cent of world population.

The existence of compulsory registration laws does not mean that the vital events specified therein are completely registered. Nor does it indicate the ability of countries to produce adequate statistics on births, deaths, and marriages.

4.3 Uses of vital records

In a country where these records have not been available, the existing needs may be few. But as each country develops, the community and the government will feel the need for more and more statistical information. The more advanced the country, the more varied and complex the requirements generally become. We must make plans not only for immediate needs but also for the future.

The following examples indicate how some of the advanced countries are utilizing vital statistics. The needs and uses may be discussed separately for:

4.3.1 Vital records relating to each individual occurrence, such as birth, death, marriage or divorce, etc., which are legally registrable events.

4.3.2 Vital statistics, that is, numerical information obtained by counting and classifying information derived from vital records.

The uses of vital records relate to individual members of the community, the community as a whole, and its government.

In many advanced countries, as soon as a child is born the parents not only make sure that the birth is registered but that they get a copy of the entries on a printed form. This is called the "Birth Certificate" and like many other certificates it has value to an individual throughout his life, so much so that it is regarded as a person's birthright. In some cases it might even be said that if a child's birth certificate has not been obtained, then from the legal standpoint at least, he does not exist. The birth certificate proves not only the fact of birth but also where, when and under what circumstances each individual was born. These uses are illustrated by the following lists prepared for the United States of America.[1]

USES OF VITAL RECORDS BY INDIVIDUALS

Birth certificate

A. *To establish date of birth*	*Purpose*
	Enter school
	Obtain work permit
	Obtain automobile driver's licence
	Obtain marriage licence
	Obtain pilot's licence
	Obtain nurse's licence
	Obtain permit to carry fire-arms, under certain circumstances
	Obtain insurance policy
	Qualify for voting
	Enlist in military service
	Enter civil service
	Qualify for pensions in private industry
	Qualify for social-security benefits
	Qualify for entrance into programmes with definite age limits, such as Civilian Conservation Corps, National Youth Administration, etc.
	Prove age of legal capacity or incapacity, particularly in Court cases where age may be an important factor. (These include cases of dependency, cases involving proof that a person is of age to enter into business contracts, etc.)
	Qualify for various Federal pensions such as civil service retirement benefits.

[1] Physicians' Handbook on Death and Birth Registration. US Dept. of Health, Education and Welfare, Public Health Service, National Office of Vital Statistics, Washington 25, DC, 11th edition, 1958.

B. *To establish place of birth (citizenship)*

Purpose
Obtain pilot's licence
Obtain permit to carry or possess firearms, under certain circumstances
Qualify for voting
Enter civil service
Obtain employment in war industry
Obtain radio operator's licence
Obtain passport
Obtain old age assistance
Obtain other Government benefits limited to citizens, such as relief
Obtain exemption from restrictions placed on aliens, as observance of curfew, internment, etc.
Obtain entrance to restricted area.

C. *To establish family relationship*

Purpose
Prove legal dependency
Obtain inheritance benefits
Receive insurance payments
Trace lineal descent

Death Certificate

A. *To establish fact of death*

Purpose
Claim insurance carried by the deceased
Settle estates
Claim pension
Trace ancestry, date and place of internment

B. *To establish cause of death*

Purpose
Claim insurance

Marriage Certificate

Purpose
Prove legal responsibility in case of non-support
Prove right to receive insurance of deceased
Prove right of inheritance to estate
Establish right to receive pension benefits of deceased
Evidence in obtaining delayed birth certificate
Prove legitimacy of offspring

DIVORCE CERTIFICATE

Purpose
Obtain release from financial obligations to other party
Obtain change of name in case of divorced woman
Prove right to remarry
Evidence in obtaining delayed birth certificate

As already stated, the uses of these records to an individual are not the only reasons why governments should maintain nation-wide systems for their collection. Their uses to governments are in fact many more than to a single individual, as explained below.

4.4 Public health uses of vital statistics

In the first chapter some uses of vital statistics have been mentioned briefly. In order to arrive at a better appreciation of their value we may consider the parallelism between the responsibility a clinician has towards an individual and the responsibility of the health officer towards his community. When an individual needs medical examination or a health "checkup", he goes to his physician who makes a number of counts or measurements of temperature, pulse, blood pressure, etc., estimates the proportion of various blood cells, and looks for the presence or absence of specific infections. The clinician is, to a large extent, engaged in observing, counting, measuring and expressing his observations on some scale of values. We entrust this counting and measuring to him because we regard him as being responsible for maintaining us in health. In the same way the health officer has a responsibility towards his patient — no longer merely an individual but the community as a whole. The health officer has to work not in a single dimension of one patient but in many dimensions requiring new techniques and new approaches to the diagnosis of community ills. Diagnostic tests are needed and are in fact available; only they are of a completely different kind, involving a novel, statistical way of thinking. Counting and measuring assume even greater importance because we are dealing with a large number of individuals. The health statistician assists the health officer as diagnostician.

His patient is the community.
His diagnostic materials are the raw statistical data.
His tools are the various statistical indices.
His techniques are those of modern statistical methodology.

Thus, the health examination or continuous checkup of a community depends chiefly upon the availability of the diagnostic material, that is, upon recording continuously and completely all such events occurring in each household. Herein lies the value of the records of births, deaths, and foetal deaths, towards which a farflung vital registration organization makes its contribution. It is with the help of this registration system that we can see

whether the "patient" for whose wellbeing the health administrator is responsible is healthy, sick, or convalescent. We need vital and health statistics to diagnose the ills of our patient, the community.

Developing this analogy in more detail, B. G. Greenberg and B. F. Mattison[1] state that "First there must be developed an awareness of the need for medical care. In the case of an individual, it usually takes the form of presenting a complaint. In the case of the community it is more subtle, and has its origins back in the organization of the health department itself." Subsequent to this awareness the private physician usually proceeds by taking case history, treatment, and finally follow-up therapy. Similar sequences by the health worker are summarized by them as follows:

"*Case history*:

(a) study of the population and its demographic structure;
(b) study of environmental, geographic, climatic, and other factors in the community.

Physical examination:

(a) further detailed study of environmental influences by inspection methods;
(b) sample surveys and censuses to measure prevalence of disease conditions, level of immunization, and others;
(c) inventories of that which is being done or performed in the community with regard to health and health problems by all persons and agencies.

Laboratory and field tests:

(a) use of tools of community diagnosis commonly referred to as vital statistics and morbidity rates or ratios;
(b) use of approved standards for comparative purposes.

Treatment:

Certain social actions may be instituted for specific purposes, such as more clinics, specialized programmes, or other public health measures.

Follow-up of effect of treatment on community:

(a) relationship of treatment to the elimination, correction, or remedial action indicated by the diagnosis;
(b) relationship of accompanying beneficial or malignant side-effects;
(c) consideration of cost."

In advanced countries, the patient/physician relationship is so well established that we have all become accustomed to the diagnostician's techniques and willingly submit ourselves to his demands, even to the extent of offering samples of our blood — demands which may seem uncomfortable and even funny to those primitive tribes who do not understand their value. Indeed, we have become so used to these procedures that unless the diagnostician puts us through all the tests we are not satisfied that he has done a good job. Unfortunately, with few exceptions, the procedures introduced by statistical science to diagnose community ill health have not reached that level of familiarity and popularity throughout the world.

Mortality statistics are being used extensively in public health work for

[1] The Whys and Wherefores of Program Evaluation, by B. G. Greenberg and B. F. Mattison. Canadian Journal of Public Health, Vol. 46, No. 7, July 1955, pp. 293-299.

making comparisons of the force of mortality among different areas, population groups, and different periods. The causes of death are studied in detail to understand the importance of what is being done by health agencies to bring them under control. In particular, deaths occurring among infants under one year of age have a special significance because mortality among infants is recognized as providing a sensitive index of the general sanitary level of the community — a kind of yardstick which health officers use. Similarly, maternal deaths are analysed to determine the causes and assess the significance of the circumstances. For example, maternal deaths when studied in relation to the type of attendance at birth (physician, trained midwife, indigenous help, or unattended), reveal saving in maternal lives through skilled care of the expectant mother during childbirth. Their analysis according to place of occurrence of the birth, whether in hospital or home, the social and economic status of parents, the age and parity of the mother, legitimacy, and so on, helps in the intelligent planning of maternal and child care.

In the absence of adequate morbidity figures, which are still unobtainable from many parts of the world, public health officers rely mostly on figures of deaths for evaluating health problems, planning health programmes, and assessing achievements. It is in this manner, for example, that the problems of tuberculosis, malaria, and other communicable diseases were first understood and the need for drugs, medical and health facilities, was estimated. Indeed, most public health problems, whether of environmental sanitation, communicable disease control or nutrition, have been revealed through an analysis of vital statistics. At the same time, these figures properly analysed reveal to the health officer the peculiar features of each disease or injury; what tendency they have to occur in certain seasons or years, and how they affect different age, sex, occupational and economic groups.

Birth notification has been used by health workers to get in touch with the mother and newborn child as soon as the event has taken place, so as to offer domiciliary service and health protection such as immunization and home nursing. Birth records have also been used to investigate failures in various kinds of health programme.

In recent years a novel use has been adopted: instead of merely measuring the loss of life by the number of deaths, we take the age at death into account and thus measure the loss in terms of "years of productive life". Considering that one person dying in the prime of life is more important economically than a dozen dying in old age, a list of priorities for health action can be established in relation to the amount of economic loss resulting from particular causes of death or injury. D. J. R. Snow[1] from Australia, analysed figures of cause of death in this manner and found that when the actual number of deaths was examined, heart disease and cancer occupied the most prominent positions, but when considered in terms of the useful years lost, their importance was much reduced. A striking transformation was seen. Automobile and other accidents occupied the leading place, cancer and coro-

[1] See: Report of the Commissioner of Public Health for Western Australia for 1951.

nary diseases being relegated to third and fifth places respectively. The importance of tuberculosis was enhanced by its moving up from seventh to fourth place. Suicide was transferred from thirteenth to seventh position. Clearly, deaths from accidents were shown to deserve the first priority in the task of prevention, (see also Section 14.4.7).

4.5 Other uses of vital statistics

Many other agencies make use of vital statistics. For instance, a number of government agencies use them to draw up their social and economic plans, measuring the effects of their operation on population changes, age and sex distribution; others need these data in connexion with housing, education facilities, and social security programmes; commercial firms rely on them in the production of goods such as medicines, food, clothing, and furniture, as well as for forecasting future needs. Actuarial science makes use of vital statistics when estimating life insurance premiums to be charged. Their success or failure in business rests on their accuracy. Many manufacturers plan their production of articles needed for children and old people on the basis of trends in births and deaths. The trend in the marriage rate is known to influence the business prospects of jewellers, furniture manufacturers and the building industry.

4.6 United Nations Principles for a Vital Statistics System

In 1953 the United Nations approved the "Principles for a Vital Statistics System"[1] representing the concensus of opinion developed over the years. These principles have the status of international recommendations and make suggestions for the improvement, reorganization and evaluation of national vital statistics systems.

The first part, consisting of nine principles, is devoted to the general aspects including a definition of the system and its function, the designation of official responsibility, the need for co-ordination and evaluation, and the place of sampling, of special surveys and of record linkage, in the vital statistics system. The second part deals with principles for legal registration in so far as they relate to vital statistics, and includes among its sixteen principles definitions of the events to be registered, a scheme of priorities of events to be employed in the establishment of a registration system, the optimum size of registration units, the nature, place and cost of registration, as well as the allocation of responsibilities. The third group of nine principles sets out recording, reporting and collecting standards, including recommendations on the form and content of the statistical report for live birth, death, foetal death, marriage, and divorce, together with a definition of each item of information to be included.

The last section contains twelve principles devoted to compilation procedures. The general goal of the compilation programme is given, the problems of coverage, both geographic and ethnic, are discussed and certain bases for tabulation are recommended, as well as a suggested annual tabulation pro-

[1] UN Statistical Papers. Series M No. 19, 1953, New York.

gramme. Thus, most aspects of the vital statistics system are covered in the four parts of the Principles and the recommendations will help any country interested in organizing, evaluating or improving its vital registration system.

4.6.1. *U.S. Principles for production of vital statistics*

The following principles to be followed in the production of vital statistics were developed by the Advisory Committee on Vital Statistics Methods in collaboration with the US National Office of Vital Statistics.[1]

Principle 1. Each vital event must be uniformly defined and the definition uniformly applied and interpreted.
Principle 2. Consistency (and comparability) of a determined minimum of data must be obtained and preserved.
Principle 3. All geographic areas must be included.
Principle 4. Vital statistics must be timely. This refers to both collection and presentation.
Principle 5. Periodic measurement of completeness and accuracy of reporting is essential.
Principle 6. Measurement and control of the accuracy of processing is essential.
Principle 7. The statistical programme must be planned and scheduled well in advance.
Principle 8. Flexibility and adaptability in procedures are essential to meet unanticipated needs.
Principle 9. Vital statistics data should be produced with the lowest total expenditure compatible with serving the needs of the public.
Principle 10. Application of principles depends upon Federal-State-local cooperation in the consideration of mutual problems.

4.7 Standard forms for vital registration

In order to ensure that information is collected on a comparable basis and that no important item is missed, one must exercise great care in drawing up the forms on which the vital events are to be recorded. Their form and content should meet local and national needs and should at the same time include the first priority items of the UN Principles for a Vital Statistics System. The wording should ensure that the results will comply with the definitions of the terms given in the Principles. In the interests of flexibility and efficiency, the report on vital events should be an individual document which provides space for recording each item of information required.

The first priority items to be included in the registration record, as stipulated in the Principles, are given below. For legal and identification purposes, full names must be added, and national needs may dictate the inclusion of other items, such as nationality, occupation etc. The terms used in the following list have been carefully defined in the UN Principles.

4.7.1 *Live-birth statistical report: priority items:*

Attendant at birth

[1] Report of the Advisory Committee on Vital Statistics Methods, Selected Studies Vol. 45, No. 14, December 4, 1957. National Office of Vital Statistics, US Department of Health, Education, and Welfare, Washington, DC.

Date of occurrence
Date of registration
Legitimacy
Place of occurrence
Sex
Type of birth, i.e. single or plural issue
Date of birth of mother; if not available, age
Number of children born to the mother
Place of usual residence (of mother)

4.7.2 *Death statistical report: priority items:*
Cause of death
Certifier
Date of occurrence
Date of registration
Place of occurrence
Date of birth; if not available, age
Place of usual residence
Sex

4.7.3 *Foetal-death statistical report: priority items:*
Date of occurrence (of foetal delivery)
Date of registration
Legitimacy
Period of gestation
Place of occurrence
Sex
Type of birth, i.e. single or plural issue
Date of birth of mother; if not available, age
Number of children born to the mother
Place of usual residence (of mother)

As examples of a full record, the forms in use in the United States are reproduced:

Form approved
Budget Bureau No. 68-R374.3

CERTIFICATE OF LIVE BIRTH

STATE OF _____ BIRTH NO _____

1 PLACE OF BIRTH a. COUNTY	2 USUAL RESIDENCE OF MOTHER (*Where does mother live?*) a. STATE b. COUNTY
b. CITY, TOWN OR LOCATION	c. CITY, TOWN, OR LOCATION
c. NAME OF HOSPITAL OR INSTITUTION (*If not in hospital, give street address*)	d. STREET ADDRESS
d. IS PLACE OF BIRTH INSIDE CITY LIMITS? YES ☐ NO ☐	e. IS RESIDENCE INSIDE CITY LIMITS? YES ☐ NO ☐ / f. IS RESIDENCE ON A FARM? YES ☐ NO ☐

CHILD

3. NAME (*Type or print*) *First*	*Middle*	*Last*	
4 SEX	5a THIS BIRTH SINGLE ☐ TWIN ☐ TRIPLET ☐	5b. IF TWIN OR TRIPLET, WAS CHILD BORN 1ST ☐ 2D ☐ 3D ☐	6 DATE OF BIRTH *Month* *Day* *Year*

FATHER

7 NAME *First*	*Middle*	*Last*	8 COLOR OR RACE
9 AGE (*At time of this birth*) YEARS	10 BIRTHPLACE (*State or foreign country*)	11a USUAL OCCUPATION	11b KIND OF BUSINESS OR INDUSTRY

MOTHER

12 MAIDEN NAME *First*	*Middle*	*Last*	13 COLOR OR RACE
14 AGE (*At time of this birth*) YEARS	15 BIRTHPLACE (*State or foreign country*)	16 PREVIOUS DELIVERIES TO MOTHER (*Do NOT include this birth*)	

17 INFORMANT	a. *How many OTHER children are now living?*	b. *How many OTHER children were born alive but are now dead?*	c. *How many fetal deaths (fetuses born dead at ANY time after conception)?*
18 MOTHER'S MAILING ADDRESS			

I hereby certify that this child was born alive on the date stated above	18a SIGNATURE	18b ATTENDANT AT BIRTH M.D. ☐ D.O. ☐ MIDWIFE ☐ OTHER (*Specify*)
	18c ADDRESS	18d DATE SIGNED

19 DATE RECD BY LOCAL REG	20 REGISTRAR'S SIGNATURE	21 DATE ON WHICH GIVEN NAME ADDED BY (*Registrar*)

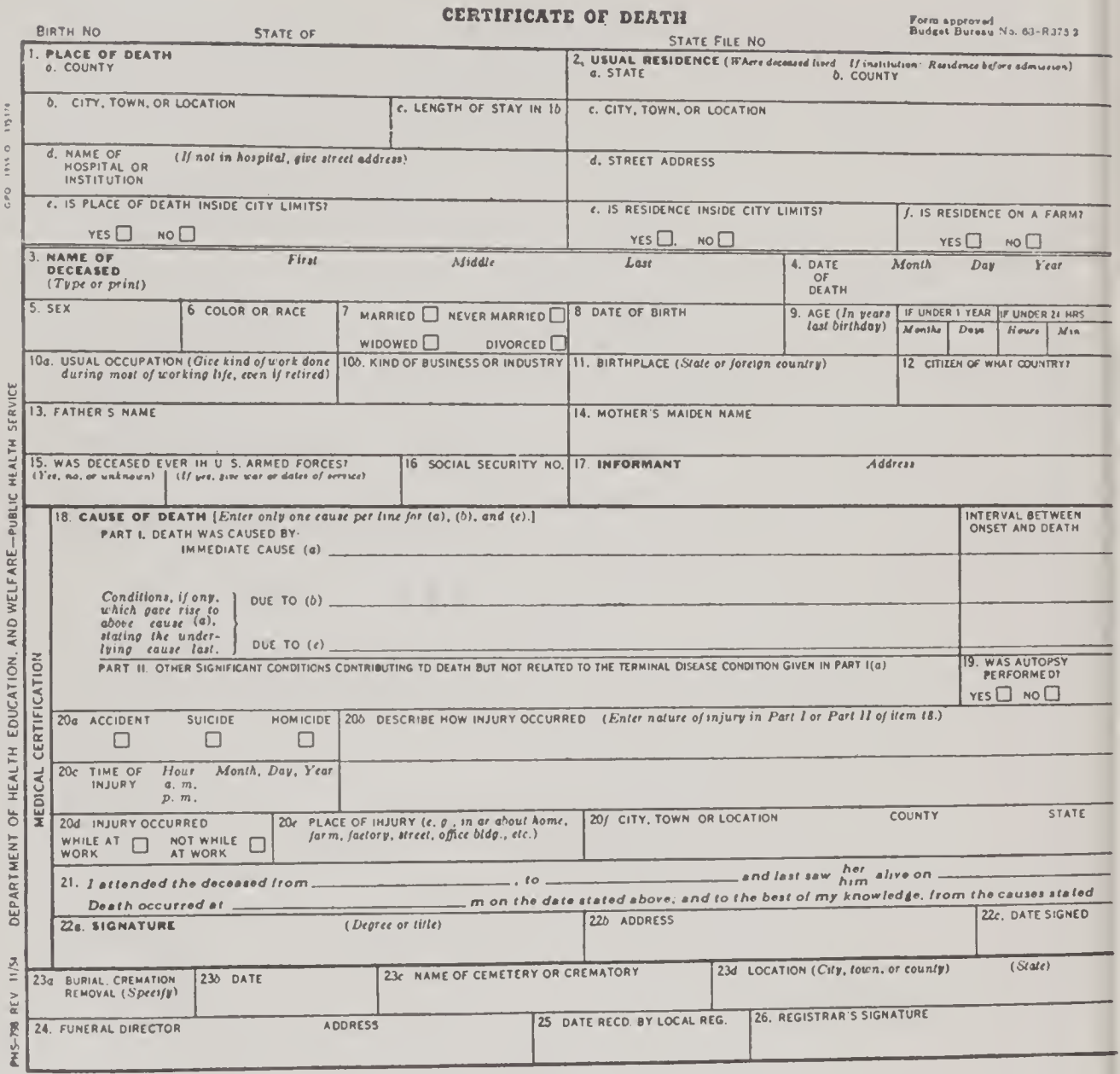
FOR MEDICAL AND HEALTH USE ONLY
(*This section MUST be filled out*)

22a LENGTH OF PREGNANCY COMPLETED WEEKS	22b. WEIGHT AT BIRTH LB OZ.	23 LEGITIMATE YES ☐ NO ☐

(SPACE FOR ADDITION OF MEDICAL AND HEALTH ITEMS BY INDIVIDUAL STATES)

DEPARTMENT OF HEALTH EDUCATION AND WELFARE—PUBLIC HEALTH SERVICE
PHS-796 REV 11-54

Fig. 4.1a



CERTIFICATE OF DEATH

Form approved
Budget Bureau No. 68-R373.2

BIRTH NO. STATE OF STATE FILE NO.

1. PLACE OF DEATH
a. COUNTY
b. CITY, TOWN, OR LOCATION
c. LENGTH OF STAY IN 1b
d. NAME OF HOSPITAL OR INSTITUTION (If not in hospital, give street address)
e. IS PLACE OF DEATH INSIDE CITY LIMITS? YES ☐ NO ☐

2. USUAL RESIDENCE (Where deceased lived. If institution: Residence before admission)
a. STATE
b. COUNTY
c. CITY, TOWN, OR LOCATION
d. STREET ADDRESS
e. IS RESIDENCE INSIDE CITY LIMITS? YES ☐ NO ☐
f. IS RESIDENCE ON A FARM? YES ☐ NO ☐

3. NAME OF DECEASED (Type or print) First Middle Last
4. DATE OF DEATH Month Day Year
5. SEX
6. COLOR OR RACE
7. MARRIED ☐ NEVER MARRIED ☐ WIDOWED ☐ DIVORCED ☐
8. DATE OF BIRTH
9. AGE (In years last birthday) IF UNDER 1 YEAR Months Days IF UNDER 24 HRS Hours Min.
10a. USUAL OCCUPATION (Give kind of work done during most of working life, even if retired)
10b. KIND OF BUSINESS OR INDUSTRY
11. BIRTHPLACE (State or foreign country)
12. CITIZEN OF WHAT COUNTRY?
13. FATHER'S NAME
14. MOTHER'S MAIDEN NAME
15. WAS DECEASED EVER IN U. S. ARMED FORCES? (Yes, no, or unknown) (If yes, give war or dates of service)
16. SOCIAL SECURITY NO.
17. INFORMANT Address

MEDICAL CERTIFICATION

18. CAUSE OF DEATH (Enter only one cause per line for (a), (b), and (c).)
PART I. DEATH WAS CAUSED BY:
IMMEDIATE CAUSE (a) _____
Conditions, if any, which gave rise to above cause (a), stating the underlying cause last.
DUE TO (b) _____
DUE TO (c) _____
INTERVAL BETWEEN ONSET AND DEATH
PART II. OTHER SIGNIFICANT CONDITIONS CONTRIBUTING TO DEATH BUT NOT RELATED TO THE TERMINAL DISEASE CONDITION GIVEN IN PART I(a)
19. WAS AUTOPSY PERFORMED? YES ☐ NO ☐

20a. ACCIDENT ☐ SUICIDE ☐ HOMICIDE ☐
20b. DESCRIBE HOW INJURY OCCURRED (Enter nature of injury in Part I or Part II of item 18.)
20c. TIME OF INJURY Hour a. m. p. m. Month, Day, Year
20d. INJURY OCCURRED WHILE AT WORK ☐ NOT WHILE AT WORK ☐
20e. PLACE OF INJURY (e. g., in or about home, farm, factory, street, office bldg., etc.)
20f. CITY, TOWN OR LOCATION COUNTY STATE

21. I attended the deceased from _____, to _____ and last saw her/him alive on _____
Death occurred at _____ m on the date stated above; and to the best of my knowledge, from the causes stated

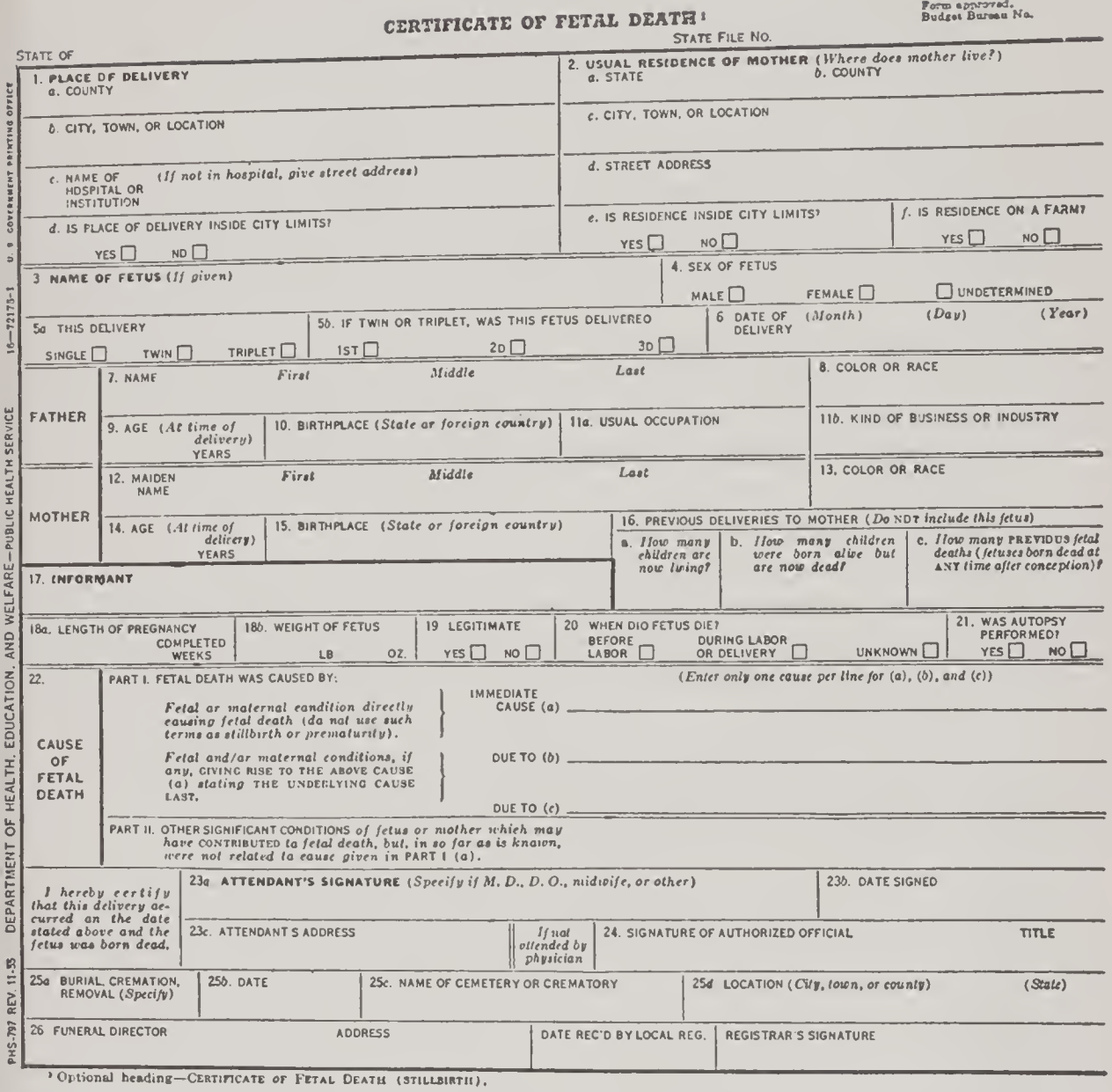
22a. SIGNATURE (Degree or title)
22b. ADDRESS
22c. DATE SIGNED

23a. BURIAL, CREMATION REMOVAL (Specify)
23b. DATE
23c. NAME OF CEMETERY OR CREMATORY
23d. LOCATION (City, town, or county) (State)

24. FUNERAL DIRECTOR ADDRESS
25. DATE RECD. BY LOCAL REG.
26. REGISTRAR'S SIGNATURE

PHS-798 REV. 11/56 DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE—PUBLIC HEALTH SERVICE
1956 REVISION OF STANDARD CERTIFICATE
GPO 1956 O 19378

Fig. 4.1b



CERTIFICATE OF FETAL DEATH[1]

Form approved. Budget Bureau No.

STATE OF — STATE FILE NO.

1. PLACE OF DELIVERY — a. COUNTY; b. CITY, TOWN, OR LOCATION; c. NAME OF HOSPITAL OR INSTITUTION (*If not in hospital, give street address*); d. IS PLACE OF DELIVERY INSIDE CITY LIMITS? YES ☐ NO ☐

2. USUAL RESIDENCE OF MOTHER (*Where does mother live?*) — a. STATE; b. COUNTY; c. CITY, TOWN, OR LOCATION; d. STREET ADDRESS; e. IS RESIDENCE INSIDE CITY LIMITS? YES ☐ NO ☐; f. IS RESIDENCE ON A FARM? YES ☐ NO ☐

3. NAME OF FETUS (*If given*)

4. SEX OF FETUS — MALE ☐ FEMALE ☐ ☐ UNDETERMINED

5a. THIS DELIVERY — SINGLE ☐ TWIN ☐ TRIPLET ☐

5b. IF TWIN OR TRIPLET, WAS THIS FETUS DELIVERED — 1ST ☐ 2D ☐ 3D ☐

6. DATE OF DELIVERY (*Month*) (*Day*) (*Year*)

FATHER

7. NAME — *First* *Middle* *Last*

8. COLOR OR RACE

9. AGE (*At time of delivery*) YEARS

10. BIRTHPLACE (*State or foreign country*)

11a. USUAL OCCUPATION

11b. KIND OF BUSINESS OR INDUSTRY

MOTHER

12. MAIDEN NAME — *First* *Middle* *Last*

13. COLOR OR RACE

14. AGE (*At time of delivery*) YEARS

15. BIRTHPLACE (*State or foreign country*)

16. PREVIOUS DELIVERIES TO MOTHER (*Do NOT include this fetus*) — a. *How many children are now living?*; b. *How many children were born alive but are now dead?*; c. *How many* PREVIOUS *fetal deaths (fetuses born dead at* ANY *time after conception)?*

17. INFORMANT

18a. LENGTH OF PREGNANCY COMPLETED WEEKS

18b. WEIGHT OF FETUS LB OZ.

19. LEGITIMATE YES ☐ NO ☐

20. WHEN DID FETUS DIE? BEFORE LABOR ☐ DURING LABOR OR DELIVERY ☐ UNKNOWN ☐

21. WAS AUTOPSY PERFORMED? YES ☐ NO ☐

22. **CAUSE OF FETAL DEATH** (*Enter only one cause per line for (a), (b), and (c)*)

PART I. FETAL DEATH WAS CAUSED BY:

Fetal or maternal condition directly causing fetal death (do not use such terms as stillbirth or prematurity). — IMMEDIATE CAUSE (a)

Fetal and/or maternal conditions, if any, GIVING RISE TO THE ABOVE CAUSE *(a) stating* THE UNDERLYING CAUSE LAST. — DUE TO (b); DUE TO (c)

PART II. OTHER SIGNIFICANT CONDITIONS *of fetus or mother which may have* CONTRIBUTED *to fetal death, but, in so far as is known, were not related to cause given in* PART I (a).

I hereby certify that this delivery occurred on the date stated above and the fetus was born dead.

23a. ATTENDANT'S SIGNATURE (*Specify if M. D., D. O., midwife, or other*)

23b. DATE SIGNED

23c. ATTENDANT'S ADDRESS

If not attended by physician

24. SIGNATURE OF AUTHORIZED OFFICIAL — TITLE

25a. BURIAL, CREMATION, REMOVAL (*Specify*)

25b. DATE

25c. NAME OF CEMETERY OR CREMATORY

25d. LOCATION (*City, town, or county*) (*State*)

26. FUNERAL DIRECTOR — ADDRESS

DATE REC'D BY LOCAL REG.

REGISTRAR'S SIGNATURE

PHS-797 REV. 11-55 DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE—PUBLIC HEALTH SERVICE 16—72175-1 U. S. GOVERNMENT PRINTING OFFICE

[1] Optional heading—CERTIFICATE OF FETAL DEATH (STILLBIRTH).

Fig. 4.1c

CHAPTER 5

Notifiable Disease Statistics

5.1 National notification of disease

In addition to the routine vital statistics collected from all parts of the country, statistics are also obtained on a national scale of certain communicable diseases which are declared "notifiable" to the health agency. While the collection of vital statistics may happen to be the responsibility of an agency other than health, those of notifiable disease must inevitably be assembled by health workers. These form part of a wider group relating to the total sickness experience of the community. Their collection on a national scale is a task requiring elaborate arrangements and constant supervision.

5.2 Promptness in notification

Several communicable diseases can spread like fire and so the prompt collection of reliable information is one of the most urgent needs of every country. For these reasons, a system for getting information about epidemic diseases is firmly established wherever there is an effective nationwide public-health organization.

Experienced health officers agree that one of the main difficulties in controlling epidemic outbreaks lies in obtaining prompt information of the occurrence of cases. Sometimes they may come to know of an epidemic only after it has died out, having caused considerable loss of life. The task of a public health worker in this respect is similar to that of a fire-fighting organization. In fact an outbreak of an infectious disease can be incomparably more disastrous than a fire. If unchecked, it may spread not only from one village to another or from town to town, but may engulf a whole country or continent, or for that matter, a large part of the world.

Even when the disease is not widespread, false rumours about the havoc may cause a panic which dislocates the social life of the country. Reliable data can often be the most effective antidote to an attack of panic. Promptness, therefore, is the first requisite in the notification of infectious disease.

5.3 Notification versus registration

The terms "notification" and "registration" have different connotations. Generally, as defined by the United Nations,[1] registration is the legal recording with the authorized officials of the occurrence of an event together with certain identifying or descriptive characteristics of the event. On the other

[1] Principles for a Vital Statistics System. UN Statistical Papers Series M. No., 19. New York, 1953.

hand, mere reporting of events such as sickness or even births or deaths, to the health officer, or in the case of certain occupational or industrial diseases, to an inspector of factories, is called "notification". The use of the term "legal" does not mean that in the case of notification there is no law making it obligatory on certain people to notify; such laws must exist. But they are enacted within the framework of the health department alone and the requirements of the law are fulfilled as soon as notification reaches the health official concerned. The difference is that while in vital registration the record has to be permanently maintained, notification law does not make such a stipulation. Thus in the case of vital registration, a register is kept of each event recorded; in the second also this is done, but it is not a legal duty, and the chief function of notification is fulfilled when appropriate inquiries concerning the case in question have been made.

5.4 Historical developments

5.4.1 *European countries*

Although vital registration has a long history, the establishment of disease notification systems followed the advent of the public health movement. Sir Arthur Newsholme has described how, in Great Britain, the notification of each case of the chief infectious diseases originated because the health officers complained that their preventive measures were belated. Epidemic diseases had obtained a firm foothold before they became cognizant of the fact through reports of fatal cases. Many towns followed the example of Bolton, Lancashire, where the first local Act enforcing the compulsory notification of the chief infectious diseases came into operation in September 1877. In 1899 a General Act was passed enforcing infectious disease notification in every administrative area, making it both compulsory and nationwide. Further improvements were made in the Public Health Act, 1936.

In Sweden, the law requiring notification dates back to March 1875 when by Royal Ordinance every doctor was required to notify to the health department cases of plague, cholera, smallpox, typhus, typhoid fever, diphtheria, dysentery, leprosy and scarlet fever. Similar laws were passed in Germany in 1900 and France in 1903.

5.4.2 *United States of America*

In the United States, the State Board of Health of Massachusetts inaugurated in 1874 a plan for the voluntary weekly notification of prevalent diseases, and over 100 physicians responded. A system of obtaining postcard information from physicians in the State of Michigan was organized, and in 1883 Michigan made it obligatory on householders to notify the health officer of infectious diseases dangerous to the public health. A similar law was passed in Massachusetts, requiring notification by physicians as well as householders. In 1878 the US Public Health Service was authorized by an Act of Congress to collect and publish data in connexion with quarantinable measures against such pestilential diseases as cholera, smallpox, plague and yellow fever, principally from foreign ports. This was followed by an Act

passed in 1893 providing for the collection of information each week from State and municipal authorities throughout the United States. Later, in 1902, in order to secure uniformity in morbidity statistics, Congress enacted a law which directed the Surgeon General of the Public Health Service to provide forms for the collection, compilation and publication of such data. At that time, reports of notifiable diseases were received from very few States, but the effect of this law was that gradually more and more States submitted monthly and annual summaries.

An important step was taken in 1913 when a Conference of the State and Territorial Health Authorities, and the US Public Health Service adopted a "Model State Law for Morbidity Reporting" which recommended weekly telegraphic reports by States for about 40 diseases, but it was not until 1925 that all States began to report regularly to the Federal Government. This model law further required that each physician who treated or examined any person afflicted with or suspected to be suffering from any one of the notifiable diseases should immediately report such a case of notifiable disease in writing to the local health authority. This report was required to be forwarded either by mail or by special messenger, with the following information:

(a) the date when the report was made;
(b) the name of the disease or suspected disease;
(c) the name, age, sex, colour, occupation, address and school attended, or place of employment of patient;
(d) number of adults and of children in the household;
(e) source or probable source of infection or the origin of the disease;
(f) name and address of the reporting physician.

Further conditions as to promptitude of notification were imposed for smallpox, diphtheria, cholera, yellow fever, etc., and it was required, in the case of diphtheria, typhoid fever, scarlet fever or septic sore throat, that the physician should state whether the patient or any member of his household was engaged in handling milk. Teachers of day or Sunday schools were required to notify suspected cases of notifiable diseases. From 1915, a few States began to use report cards with a penalty for non-reporting.

Reciprocal notification of diseases in persons presumably infected outside the State was practised by Minnesota as early as 1914. In 1917 the State and Territorial Health Authorities recommended the general adoption of the practice.

In 1944, William Fowler[1] made an inventory of diseases reportable under laws and regulations in individual States. In some States the list included even dog bites, drug addictions, physical defects in children, and food poisoning. One interesting thing that emerged from a study of the State laws and regulations was the large list of diseases and conditions primarily due to the nature of the occupation or employment. Some 70 of these diseases and conditions are mentioned by Fowler.

[1] The Reportable Diseases, by William Fowler. Public Health Reports, Vol. 59, No. 10, March 1944, pp. 318-340.

In other countries of the American continent a programme for exchanging information on communicable diseases has been in operation since the founding of the Pan-American Sanitary Bureau in 1902.

Thus, while the original purpose of reporting communicable diseases was to find out, as early as possible, the appearance in the community of diseases dangerous to the public health, especially the pestilential diseases, so as to apply control measures, subsequent developments have brought many other uses. They have shown the needs for changes in procedure. This is because increased knowledge about disease behaviour and characteristics demanded quick changes in reporting, collecting and disseminating data essential to meet new situations. In the same period the needs of areas adjacent to infected areas, of States, Federal Governments, other countries, and international agencies, have become increasingly felt. Today it is not only the health officer of the area, but health authorities throughout the world who are interested in ensuring that an efficient system covering disease notification, prompt publication and dissemination of information operates smoothly and effectively, in normal times and particularly in times of national emergency or catastrophe.

5.4.3 *Recent developments*

Various attempts at improvement have been made, culminating in the publication in 1955 of the revised "Guide for the reporting of communicable diseases in the Americas". The revision followed the recommendations made in 1953 by a seminar held in Chile, to improve procedures and to prepare recommendations for local, national and international reporting of communicable diseases.[1] In the United States, two publications are noteworthy: "Control of Communicable Disease in Man", published by the American Public Health Association, and "National Morbidity Reporting: Manual of Procedures", effective 1 January 1956, published by the US National Office of Vital Statistics.

5.4.4 *Progress at the international level*

International interest in communicable disease reporting dates from the recognition, over a hundred years ago, of the rôle of sea travel in spreading epidemics. In 1851, a conference was convened in Paris, attended by twelve European countries, at which "epidemic intelligence reports from independent medical officers stationed in areas from which infection came, were considered of great value" and the recommendation was made that this reporting should be extended. Several advances have since been made. Exactly 100 years afterwards, in 1951, internationally agreed sanitary regulations were adopted by the World Health Assembly as WHO Regulations No. 2, prescribing the manner (through telegraph and weekly reports) in which the

[1] The Report of the Seminar is entitled "Basic procedures for the reporting of communicable diseases" (PASB Scientific Publications, No. 9, March 1955).

occurrence of every case of six diseases termed "quarantinable"[1] in any part of the world is to be reported by the national health authority to the World Health Organization for distribution of the reports to all other countries. Revision of these Regulations took place in 1955, becoming effective in October 1956.

In 1951, the Expert Committee on Health Statistics of the World Health Organization considered the problem of notifying communicable disease and recommended methods to improve notification, such as seeking the fullest co-operation from the medical profession and health institutions, avoiding duplication of notification, ensuring correction of final diagnosis and the use of clinical and laboratory examination reports. Various conferences, expert groups, etc., have evolved standard procedures and designed forms to be used in connexion with the operation of a worldwide system of notifying communicable disease.

From small beginnings some 60 to 70 years ago, national systems of disease reporting have come into existence wherever health departments are serving the people, and a good deal is being done to coordinate the activities. The World Health Organization collects information from all parts of the world with the minimum of delay and makes it available to all countries. The occurrence of any disease outbreaks in the area of their destination is notified by radio to ships and aircraft.

5.5 Purposes of notification

The precise purposes will differ from one disease to another but we may recognize two main ones: immediate and subsequent.

5.5.1 *Immediate purposes*

1. To secure prompt action for preventing the spread of infectious disease, for ascertaining its source, and so far as practicable inhibiting the action of the infecting cause. Thus, notification should lead to confirmation of diagnosis, isolation, treatment of patients, and examination, immunization and surveillance of contacts. This applies whether infection is from human sources (e.g. an undetected case of the same disease), or from water or milk infected by discharges from an infectious case, or from some other source of infection. The importance of notification itself depends on the extent to which action for the control of the notified disease is exercised.

2. To disseminate epidemic news warning the health authorities and people of the affected area as well as those in adjoining areas and of other countries, of the progress of the disease.

3. To educate parents, householders, teachers and social workers and still more the members of local health authorities by means of inspections

[1] The "Quarantinable Diseases" are plague, cholera, yellow fever, smallpox (including variola major and variola minor (alastrim)), typhus (louse-borne) and relapsing fever (louse-borne). See International Sanitary Regulations. Annotated Edition. World Health Organization, 1957, Geneva.

resulting from notification. Notification has increasingly stimulated local authorities in the discharge of their duties.

5.5.2 *Subsequent purposes*

W.P.D. Logan, reviewing the long-term purposes of notification, states that many lessons are learned in retrospect by studying the records of past events and deriving guidance therefrom as to the future. The records may be used:

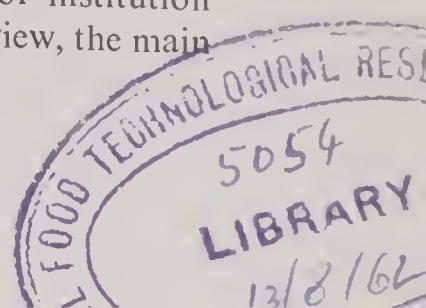
1. To obtain scientific knowledge especially the kind that helps health agencies to plan more effective programmes for the prevention and control of these diseases.
2. To obtain information on the seasonal, annual, epidemic and cyclical prevalence of the disease for use in epidemiological studies on the natural history of the disease, its aetiology, its epidemicity, its relation to age and sex, urban and rural life, to social and environmental conditions, and to the complex meteorological conditions involved in the words season and climate.
3. To contribute to the study of the time trends of incidence, in local areas, in regions, and in the country as a whole, and thus provide an evaluation of the effectiveness of immunization programmes or other control measures on an objective basis.
4. To contribute to the system of total sickness statistics in a community, illustrating the incidence of sickness by age, sex, occupation and other factors, and its social implications.
5. To provide material to those engaged in medical research and medical practice who often need and ask for data separately for parts of a country or for several countries. Incidentally, this need is apparent in requests for information which may be used in the preparation of papers read at scientific meetings, or for publication in journals and books.
6. To meet the demands for health education and from official and non-official health agencies, press, radio, feature writers, etc.
7. To meet the needs of commercial organizations, such as insurance companies, manufacturers of pharmaceutical and biological products and other business corporations in the planning and development of their services and products.

5.6 Procedures for notification system

We may consider the disease notification system at four separate levels:

(a) first and foremost is the interest of the local health authority, which must necessarily be informed of the disease in its own particular areas as well as in the areas from which the disease may enter;
(b) the compilation of data at district, state or provincial level;
(c) the collection of information under national auspices;
(d) for certain diseases a report made by national health authorities to the World Health Organization.

The first step is taken by the local health officer who has to ensure that the occurrence of communicable disease in any single household or institution is promptly brought to his notice. Looked at from his point of view, the main questions on which he needs guidance are: -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(a) What diseases should be declared notifiable?
(b) Who should be made responsible for notification, and to whom should notification be made and by what means?
(c) Within what time should notification be made, and what should the health officer do to ensure prompt notification?
(d) What should be the penalty for failure to notify; or what should be the fees or rewards for notification?
(e) What should be done to ensure complete notification; how to assess incompleteness? What are the various sources of information to be tapped and how to secure co-operation from physicians?
(f) What should be done to ensure accurate notification by definite diagnostic evidence, revision of diagnosis, correction for place of occurrence, etc?
(g) What suitable record cards and reporting forms should be used?
(h) In addition to the first case of the disease, what periodical reports — daily or weekly — must be made promptly to the health department?

5.7 What diseases should be notifiable?

The number of diseases that should be declared notifiable in different countries varies according to the stage of development of the country, the availability of medical or other staff to diagnose cases of infectious disease, the accuracy with which cases can be notified, the frequency of disease in the area, its potential public health importance, and the relative urgency for immediate knowledge of the existence of the disease. Within each country the list would vary between urban and rural areas and again in the urban areas may vary from large cities to small towns. Apart from the obligation to include the six "quarantinable diseases" flexibility in communicable disease reporting is essential.

The American Public Health Association in its "Control of Communicable Disease in Man" has grouped 118 communicable diseases into five major classes:

Class 1. Case report universally required by International Sanitary Regulations (6 diseases).
Class 2. Case report regularly required wherever the disease occurs (29 diseases):
  A. Case report by rapid means (14 diseases)
  B. Case report by most practicable means (15 diseases)
Class 3. Selectively reportable in recognized endemic areas (37 diseases):
  A. Case report by rapid means (3 diseases)
  B. Case report by most practicable means (23 diseases)
  C. Collective report (11 diseases)
Class 4. Obligatory report of epidemics; no case report required (19 diseases).
Class 5. Official report not ordinarily justified (23 diseases).

A distinction has been made between reporting epidemics of certain diseases and reporting individual cases. Epidemics, or substantial increases

above the usual level of morbidity brought to the notice of health officers by physicians, by news reports, or by school or industrial absence records, should be promptly reported. There are two reasons for putting a disease in this category: the one, that it may be a disease where an outbreak is more easily recognized by its characteristic epidemic pattern than by clinical diagnosis in the individual patient; the other, that although individual cases have very little public health significance, epidemics of national or international significance can develop. Epidemic reporting of influenza, for example, may be justified on both these grounds.

In the WHO Annual Epidemiological and Vital Statistics,[1] 1955, there appears a list of diseases which were declared notifiable in various countries in that year.

While we can obtain guidance from the list of diseases at present notifiable and as published by WHO, we may also take note of the recommendations of certain committees. In 1953, the Pan American Sanitary Bureau Seminar in Chile on the Reporting of Communicable Diseases recommended the following list of diseases in addition to quarantinable diseases for which individual reporting is justified.

List of notifiable diseases (*PASB*)

1. Diphtheria; 2. Encephalitis, virus; 3. Gonorrhea;
4. Influenza; 5. Malaria; 6. Meningitis, meningococcic;
7. Poliomyelitis (a) paralytic forms, (b) non-paralytic forms;
8. Rabies (a) human, (b) animal; 9. Scarlet fever;
10. Syphilis, contagious; 11. Tuberculosis of the respiratory tract;
12. Typhoid and paratyphoid fever; 13. Typhus, murine;
14. Venereal diseases, other; 15. Whooping cough.

Recommendations were also made that each country should add to the list any other disease of importance within its territory; and take steps to obtain information on epidemics of important diseases, especially those that might be confused with quarantinable diseases.

5.8 Who should notify and to whom?

For administrative purposes, prompt notification should be made to the Medical Officer of Health who is responsible for preventive action. For scientific purposes, the notification should be assigned either to the area where the disease was contracted or, in order to be comparable with mortality statistics, to the area of residence of the patient, according to the purpose which is to be served. Statistics are at present generally compiled on the basis of the area in which notification is made.

In earlier days, owing partly to the paucity of medical practitioners, the duty of notification was imposed on the head of the household, then (in default) on the nearest relatives present or in attendance, then on the persons

[1] WHO Annual Epidemiological and Vital Statistics, 1955, Table 73. See also: USA Manual of Procedures. National Morbidity Reporting.

in charge of or in attendance on the patient, and then on the occupier of the building. It was also placed concurrently on the medical practitioner in attendance or called in to visit the patient. In many recent laws the duty falls exclusively on the medical practitioner who is called to attend the case and notification is required to be made by him to the health officer of the locality.

The ideal source of reports is of course the physician, but it is necessary to think of all possible channels through which a note of the "first case" can be received and to give encouragement, through rewards if necessary, to make sure that notification is complete and prompt. Other sources of information are the following:

(a) public health personnel
(b) hospitals and other institutions
(c) other professional workers (veterinarians, midwives, etc.)
(d) school teachers
(e) civil, military, church, and other authorities
(f) registrars (for death certificates)
(g) laboratories, pharmacies
(h) the Press

Prepaid postcards have been distributed in many rural areas to ensure that the report is made quickly. All means of obtaining a fast news service must be considered and utilized. Expenses incurred in connexion with the sending of prompt reports by telegraph, telephone, etc., should be a legitimate charge on public health budgets.

The "quarantinable diseases" are notifiable directly to the national health authority by port medical officers and medical officers responsible for aerodromes, as well as by all local medical officers of health.

5.9 Manner in which report is made

The report should always be in writing, in order to provide records for administrative purposes, but this requirement should not preclude the additional use of more rapid means of reporting important cases (verbal, telephone, telegraph, radio etc.)

5.10 Data to be reported

To facilitate and encourage the active participation of the physician, the local health service should request from him only such data as are absolutely necessary for establishing contact with the patient and persons concerned.

The minimum basic data recommended are: name of the patient, age, sex, residence, diagnosis, place and date of the report, and name of the person reporting.

An individual report card should be prepared for each case. A sample form for reporting communicable diseases with the basic minimum data is given below. Each country should determine the most suitable form for the sealed report by mail.

Form for the reporting of communicable diseases with minimum data

REPORT OF COMMUNICABLE DISEASE

Name . . . . . Age . . . . . Sex . . .
Full address . . . . . village, city, or town
Disease . . . . . .
Reported by . . . . . .
Full address . . . . . village, city or town
Date . . . . . Signature . . . . . .

Decisions regarding the following points are generally left to the discretion of each local public health authority: The advisiability of

(1) recording other data considered necessary to aid in the identification of the case;

(2) including a question directed to the physician as to whether he needs the assistance of the health department;

(3) using special forms for institutions such as hospitals or laboratories.

For reports from other sources, each health authority should distribute a simple appropriate form.

5.11 Delay in notification

Medical practitioners, and others responsible for notification, should be required to notify a case "forthwith on becoming aware" that the patient is suffering from one of the notifiable infectious diseases. Rules or laws of many countries require that this report be made within 24 hours (in some cases 12 hours) of the occurrence of the case.

Quarantinable diseases are required to be notified to the World Health Organization within 24 hours by means of telegraph (see Appendix IIIb, Article 3). Subsequent diagnoses also should be communicated within a similar time.

Delay in notification can arise from circumstances other than delay in reaching a definite diagnosis. For instance, notification may be overlooked at the proper time or, during a busy spell and contrary to the regulations, a practitioner (or hospital) may accumulate a number of cases and notify them in a batch when he can find an opportunity to do so.

5.12 Completeness of notification

An Act or Regulation requiring notification by law of a particular disease does not automatically result in complete and accurate reporting. This depends on a number of complex factors pertaining to the disease in question, to the patient, and to the physician making the report. Completeness of reporting is influenced by the ease with which the disease is diagnosed, whether on clinical grounds or by laboratory procedures, whether the disease is sporadic and rare, or occurs in endemic or epidemic form, whether the disease is amenable to control, and also by the gravity of its immediate or remote effects. It also depends on the background and training of the

physician who is called upon to make the report, what his interest may be in the disease or in the patient suffering from it, how busy he may be, how much popular appeal the disease may have at the time, whether notification of the disease will result in benefits, such as the provision of free drugs or immunizing materials, or benefits to the patients, such as free hospitalization. Important factors also are the age of the patient, difficulties of travel and communication and how unnecessarily detailed and burdensome the physician believes the report form to be.

The efficacy of notification of infectious diseases in general varies from area to area and from disease to disease. In general it may be stated that notification is most likely to be complete when the practitioner is really satisfied that notification will bring some benefit to his patient or to the community, and least likely when he feels that the only result will be bureaucratic interference.

Various methods have been used for estimating the degree of incompleteness of notification systems. E. G. Lossing[1] compared the reports received with the information obtained through a household morbidity survey in Canada, and the following table shows the percentage of cases that were so notified for certain diseases. Similar percentages from two other studies are also given in the table.

TABLE 5.12

Estimated completeness of reporting of certain communicable diseases. Estimated per cent of cases that were reported

Disease	Canadian Sickness Survey Preliminary figures	Hagerstown Study (1922-23)	Stocks (England 1944-47)
	%	%	%
Measles	13.8	27.9	66.0
Whooping cough	10.9	16.8	20.0—24.0
Chickenpox	17.3	17.6	—
Mumps	13.9	—	—
German measles	17.1	—	—

British experience is more complete, and Lossing says that the reasons may be (1) the institution of the National Health Service, and (2) the fact that physicians in the United Kingdom receive a fee for notification.

Another method for judging completeness of notification can be used for some specific diseases. Measles for instance is a universal disease readily diagnosed, and over 90% of the cases occur at ages under 20 years. We should therefore expect that the incidence rates of notified measles in the susceptible populations of individual parts of any country over a number of years would be substantially the same. So any variation in the reported incidence rates among different parts of the country would indicate comparative

[1] Reporting of Notifiable Diseases, by E. G. Lossing, Canadian Journal of Public Health, November 1955, pp. 444-448.

under-reporting. A study of under-reporting of measles could thus provide a yardstick for measuring also the completeness of reporting of common communicable diseases.

Yet a third method is to study the variation from one place to another of the ratio of reported cases to total deaths from the same cause. Some indications of under-reporting can also be obtained by comparing the notification records with the results derived from other sources, such as surveys and questionnaires, school absenteeism records, hospital records, public health laboratory records and certified causes of death.

Percy Stocks examined the completeness of notification of certain infectious diseases in England and Wales, and concluded:

Acute poliomyelitis Cerebro-spinal fever Diphtheria Scarlet fever	Notification fairly complete
Respiratory tuberculosis	Probably nine-tenths notified
Typhoid and paratyphoid fevers	Probably four-fifths notified
Measles	About two-thirds notified
Pneumonia	From a third to a quarter notified
Whooping cough	From a quarter to a fifth notified
Erysipelas Non-respiratory tuberculosis	Defective to an indeterminate degree
Dysentery	Notification only fractional

If such indices of under-notification can be established in a locality in respect of each disease, one could then form an approximate idea of the total incidence by multiplying the reported number of cases by an appropriate factor.

5.13 Methods for improving the notification system

Among the methods suggested for improving completeness of notification are legal, educational, and administrative measures.[1]

5.13.1 *Legal measures*

Each country should establish laws and regulations for the reporting of notifiable diseases, taking into account the possibility of: (a) omitting diseases or adding them to the existing list in each country, and (b) modifying reporting procedures.

5.13.2 *Educational measures*

Efforts should be made to publicize as widely as possible the usefulness of reporting. The following groups should be covered, using the methods described for each.

1. *Health officials and organizations*, with their staffs (physicians, public health nurses, health inspectors, statisticians, etc.) through;

[1] Basic procedures for the reporting of communicable diseases. PASB Scientific Publication No. 9, March 1955, Washington, DC.

(a) periodic communication of legislation and regulations;
(b) frequent distribution of statistical data, publications and instructions;
(c) seminars and meetings;
(d) specialized courses;
(e) other means of providing information.

2. *Medical profession.* The physician has the primary responsibility for reporting. His instruction in this work should extend from the time he is a medical student through varied grades of specialization. Accordingly, the profession should be divided into two groups:

(a) students in schools of medicine and of public health:
  (i) through related courses (hygiene, legal medicine, infectious diseases, epidemiology, etc.) and by supplementing the study of each clinical case with mention of reporting requirements, when relevant, and the method of reporting;
  (ii) through publications, instruction and practical work (preparing, filling in and analysing report forms);
(b) physicians;
  (i) through publications, such as weekly and monthly reports, local and eventually national reports;
  (ii) through instructions by letters, circulars and other material;
  (iii) by seminars, meetings, special courses, and discussions of the subjects in congresses, meetings, scientific societies, etc.;
  (iv) by collaboration of organized medical groups, such as societies, colleges, associations, etc.

3. *Related professions*, (nurses, pharmacists, odontologists, laboratory workers, midwives, veterinarians, etc.). The close ties of this group of professional workers with medical practice make these persons valuable aides in reporting, both in their own professional capacity and as collaborators. The educational activities planned for this group would be similar, in so far as pertinent, to those recommended for the medical profession with similar stress laid on the need for instruction starting in the student period.

4. *Other selected groups*, (school teachers, armed forces, professionals engaged in social and religious work, etc.). Since persons in those groups come into contact with and exert influence on various segments of the population, they should be considered as occupying a special place. Also in this group attention should be given to instruction of both student and professional worker:

(a) to the students, through courses and studies, publications, instructions and publicity;
(b) to professional workers, through publications, instruction and publicity.

5. *Administrative authorities*, agencies, etc. through publications, instruction and publicity.

6. *The public in general.* In school-age children, mainly through the teacher, and in adults, by means of posters, movies, press and radio, discussions, etc.

5.13.3 *Administrative measures*

Under this heading are included measures designed to promote prompt reporting. These consist principally of the following:

1. distribution of printed report forms;
2. facilities for reporting:
   (a) postal and telegraphic franking privileges, etc. for the person reporting;
   (b) priority for the transmission of reports;
   (c) collection of reports directly by the local health authority;
3. participation of local authorities other than those of the health services, in order to improve notification.

Consideration should be given to the possibility of certain authorities, not specifically concerned with curative or preventive medicine (military, police, politico-administrative, judicial, etc.) assisting in the improvement of reporting.

4. Establishment of facilities in the health services, such as:
   (a) diagnosis, clinical and laboratory facilities,
   (b) isolation,
   (c) treatment,
   (d) prophylaxis.
5. Co-ordination among the different public or private institutions and agencies interested in the control or treatment of notifiable diseases to promote in every possible way the fullest compliance with the reporting requirements. Included in this group are pharmacies, clinical laboratories, etc., in addition to medical-care establishments. There must be an exchange of information between the various sections of the same institution, as well as among the different institutions of the country.

5.14 Co-operation from physicians

The key to satisfactory notification of disease lies in securing the willing co-operation of the physician, i.e. general practitioners, including of course medical officers in various institutions, such as schools, estates and colonies. Past experience shows that the reasons why a physician may fail to report a case of a notifiable disease may be:

(a) That he is not aware of the existence of any legal provision requiring a report from him. The practitioner should have a list of the notifiable diseases.

(b) That he is busy and lacks clerical assistance. In some countries the practitioner is paid a fee for making the report, as against a penalty for failure to notify. The fee may cover clerical expenses. In addition, the practitioner should be supplied with a liberal quantity of standard cards for

notification requiring the minimum of clerical work, and the card should be franked for posting.

(c) That the supply of forms on which to make the report has run out.

(d) That notification is distasteful to the general practitioner because it is followed by an enquiry into the case by the local health department. On the other hand, if the health officer were not to make an enquiry, he would be criticized if no action were taken after notification. The solution to this lies therefore in securing the co-operation of the practitioner in the enquiry so that he is made to feel that any action taken by the local health staff is equally in his interest.

The general practitioner should be encouraged to regard notification more as a professional than a mere statutory duty. The interest of the medical profession in notification could be kept active if the health department were to forward to the medical practitioners from time to time summaries of disease reports as well as other reports of interest on the behaviour of individual diseases in their communities. In many departments, free facilities provided for undertaking laboratory examination of pathological samples from patients notified by the physician under this system have proved an incentive to notification.

5.15 Notification of non-infectious diseases or conditions

Notification can be extended to non-infectious diseases where controllable factors may be apparent, and to disease in which etiological factors of social and environmental nature may be of significance — for example: avitaminosis (beriberi, pellagra), occupational diseases (silicosis, anthracosis, lead, arsenic, phosphorus poisoning, etc.), occupational cancer and even mental illness. A great deal of mental disorder is already, in effect, notified to the medical officer of health.

There are also a number of other diseases and conditions of public health importance such as accidents, congenital deformities, occupational diseases and perhaps certain of the chronic diseases such as multiple sclerosis, for which data would be of value. Although routine reporting of this group of conditions at present is not suggested, it may be possible to secure the co-operation of the physicians to report on one or more of these conditions over a limited period as part of a special investigation.

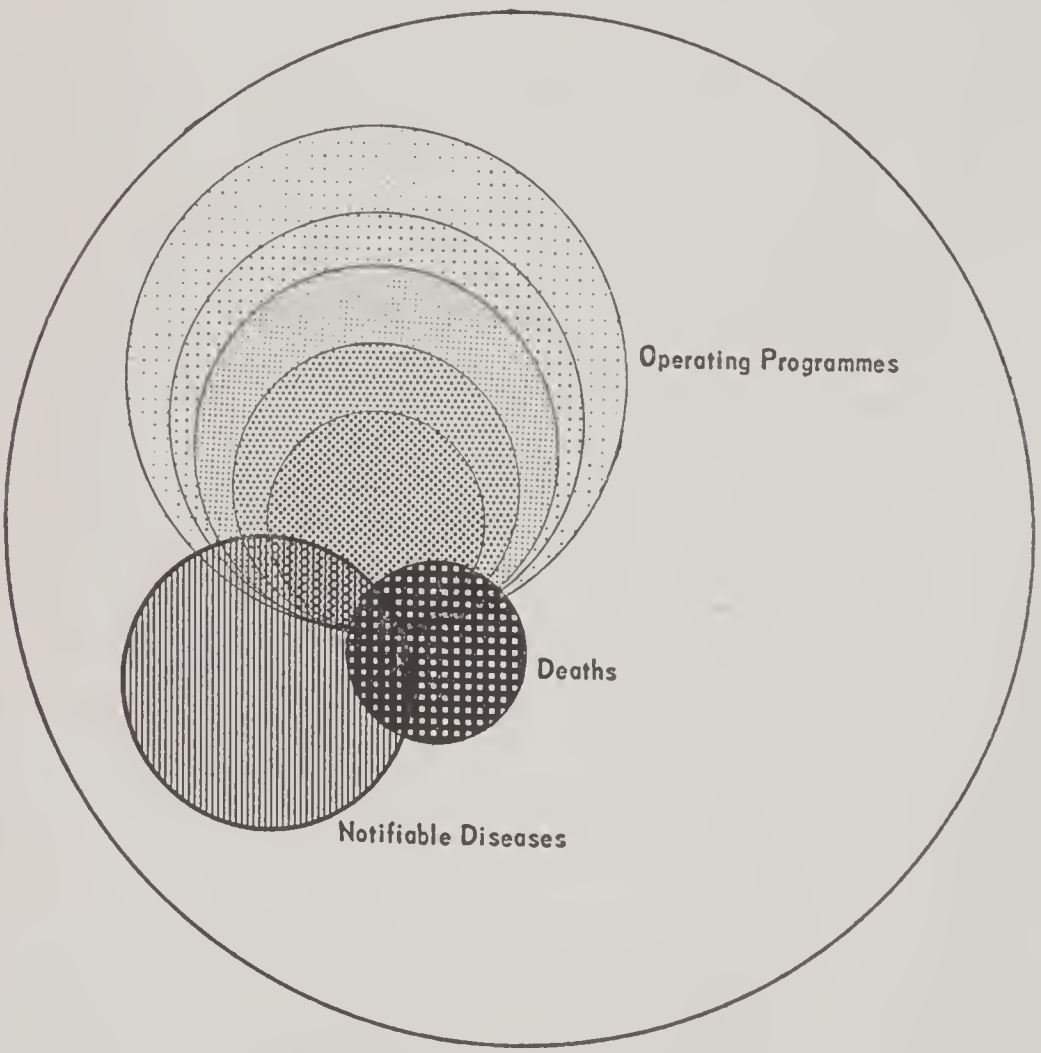
CHAPTER 6

Morbidity Statistics

6.1 Need for and importance of morbidity statistics

In spite of fairly extensive organizations in various countries for the collection of vital statistics and notifiable disease statistics, there still exists an enormous gap in our knowledge of the general health status of populations. This is because until recently we did not possess any satisfactory system for ascertaining the total amount of sickness arising from all causes; nor could we follow the changes taking place from time to time in the health status of the people.

KNOWLEDGE OF HEALTH STATUS OF POPULATION



White area shows lack of information on health statistics

Fig. 6.1

To quote Charles Dickens, "It concerns a man more to know the risk of the fifty illnesses that may throw him on his back than the possible date of the one death that must come. We must have a list of the killed and of the wounded too."

Our lack of statistical knowledge of sick people is illustrated in Fig. 6.1. The largest circle represents the total sickness experience. Statistics on death and notifiable disease cover only a small fraction of the total area. Operating health programmes such as maternal and child health centres, and communicable disease control, provide additional information depending upon the coverage of the programmes. Still a large part of the outer circle is left uncovered.

The need for this missing information on sickness has been felt for a long time but more recently it has been considerably accentuated because of national and group insurance schemes and the growth of the welfare state.

In view of the high economic loss and social disturbance caused by sickness and the cost of medical care, we need accurate information to plan preventive measures on an adequate basis. The amount and duration of sickness, and not merely the mortality from it, are of importance in influencing the prosperity of a community.

Briefly stated, the usefulness of morbidity statistics lies in general in their giving information on the following:

(a) how many people suffer from particular diseases, how often and for how long;
(b) what demands these diseases place on the medical and public health resources; and what financial loss they cause;
(c) how fatal the different diseases are;
(d) to what extent people are prevented by these diseases from carrying on their normal activities;
(e) to what extent diseases are concentrated in particular groups of the population, e.g., according to age, sex, ethnic group, occupation or place of residence;
(f) how far the above factors vary from time to time (variation according to season or from year to year);
(g) what is the effect of medical care and health services on the control of disease incidence.

6.2 Historical developments

Three quarters of a century ago in the supplement to the thirty-fifth report of the Registrar General for England and Wales, Dr. William Farr[1] emphasized the need for the collection of sickness statistics:

> "The reports of the existing medical officers are of great practical value, and will become more valuable every day. What is wanted is a staff officer in every county or great city, with clerks, to enable him to analyse and publish the results

[1] Vital Statistics, by William Farr. Memorial Volume of Selections edited by Noel A. Humphreys. Office of the Sanitary Institute, London, 1885.

of weekly returns of sickness, to be procured from every district; distinguishing the new cases, the recoveries, the deaths reported weekly, and the patients remaining in the several hospitals, dispensaries, and workhouses. These compiled on a uniform plan, when consolidated in the metropolis, would be of national concern. . . The thing to aim at ultimately is a return of the cases of sickness in the civil population as complete as is now procured from the Army in England."

In 1860, Florence Nightingale is reported to have urged the adoption of Farr's classification of diseases for the purpose of tabulating hospital morbidity records. "Dr. Farr wrote in January 1860: 'I have a New Year's gift for you. It is in the shape of tables.' 'I am exceedingly anxious to see your charming gift,' she replied, 'especially those returns showing the Deaths, Admissions, Diseases'. However exhausted Florence might be the sight of long columns of figures was 'perfectly reviving' to her."[1]

During the 19th Century attempts made to develop morbidity statistics led to two different methods of approach. Statisticians were concerned with devising a suitable classification of disease, whereas hospital authorities were interested in nomenclature. The two differed because nomenclature is a list of all the approved terms for describing and recording clinical and pathological observations. It has to be extensive enough to include all possible conditions. A statistical classification, on the other hand, is a method of generalization. Its primary purpose is to furnish quantitative data that will provide information in terms of a specific and limited number of groups. These attempts have culminated in the preparation and publication by the World Health Organization of an International Statistical Classification of Diseases, Injuries, and Causes of Death.[2] A number of nomenclatures have been published, but none has won international acceptance. Perhaps the best known is the Standard Nomenclature of Diseases and Operations[3] published by the American Medical Association.

6.3 Problems in the collection of sickness data

Although the difficulties of devising a statistical classification of diseases have been surmounted, no successful attempt appears to have been made until recently for the routine collection of statistical information on total morbidity for the entire population. Indeed, many new problems are arising in the collection, study and presentation of morbidity data. Morbidity statistics are obviously more complex than data on death; illness is not an instantaneous happening and the definition of what constitutes illness is by no means simple.

6.3.1 *Problem of definition*

We need both a definition of what we are attempting to measure and

[1] From "Florence Nightingale" by Cecil Woodham-Smith, p. 336.

[2] International Classification of Diseases, 1955 Revision, Vol. 1. World Health Organization, 1957, Geneva.

[3] Standard Nomenclature of Diseases and Operations. Edited by Richard J. Plunkett and Adaline C. Hayden. American Medical Association. The Blakiston Co., Philadelphia, 1952.

record, and a scale of measurement. The dividing line between illness and health is often indefinite. Individuals respond differently to infection by certain organisms and in some cases there may be no apparent departure from health, while in others infection may be accompanied by acute symptoms.

6.3.2 *Fixing the scale of illhealth*

There is in fact a big zone of uncertainty in health and sickness. Even the normal state of man is liable to considerable fluctuation from one individual to another and in the same individual at different times. Tests have shown that apparently healthy individuals vary widely in such particulars as pulse rate, blood pressure, blood sugar, haemoglobin rates and blood counts. Measurements which in one person may be associated with moderate or even serious illness may be compatible with normal activity in another. Again, while two individuals may appear to be in precisely the same bodily condition by every criterion of observation and measurement at our disposal, the one may be sick and the other not sick because he has greater powers of adaptability.

6.3.3 *Problem of diagnosis*

The accuracy of disease diagnosis depends upon the doctor's knowledge and the diagnostic facilities available. Both these factors may change with the advance of medical knowledge and the development of new techniques. Moreover, the diagnosis of the same doctor in regard to a patient may change during the course of a single illness as new symptoms appear.

Often the patient himself has to decide whether he is suffering or not. If he believes he is ill, then he is not in normal health — he is consciously suffering from something and therefore may legitimately be regarded as sick. On the other hand, a person may not be aware that he is sick and only a clinical examination, such as an X-ray at the time of an insurance examination, may reveal that all is not well.

6.3.4 *Criteria of ill health*

There are three principal criteria for establishing ill health:

(a) The opinion of the individual affected. If a person believes himself to be ill, he could be considered so even though a physician may not be able to identify a disease.

(b) Clinical examination by a physician.

(c) Diagnostic tests. Contrary to general belief, diagnostic tests do not always yield diagnoses. A diagnostic test may be qualitative, such as an X-ray film, or it may give a reading on a quantitative scale. Criteria for relating specified scale values to various degrees of ill health must be established before the results of such tests can be interpreted in terms of illness.

From the standpoint of statistics of morbidity, we may define the starting point of illness as when either:

(a) the subject himself began to be conscious of symptoms of some disability; or
(b) someone else decided that disease was present and could not be ignored without risk to the patient.

Any morbidity study will be incomplete if it uses records from one source alone. The separate sets of data collected by different agencies are limited by the administrative purposes of the agencies concerned, and the study of morbidity must integrate all interpretations of sickness to form the basis of planned provision for all needs.

6.3.5 *Morbidity terminology*

Without a clear and agreed common purpose in the study of morbidity, there is interminable discussion on the definition of sickness, for everyone's definition is framed to suit his point of view.

Once a definition has been formulated to suit a specific need or situation, it may become possible to define onset, termination and duration, and to distinguish new, recurrent and continued illness. Grades of illness such as major, minor and ill-defined, and such terms as complication and incapacity also need to be defined.

In formulating these definitions we must maintain a clear distinction between the illness itself and the effects it has upon the activities of the sick person. It is possible (and tempting because of its greater simplicity) to define severity and duration in terms of what the subject does (e.g., by the number of days away from work or confined to the house or whether attended by a doctor or certified as unfit or eligible for certain sick benefits) rather than in terms of the actual bodily condition. Since one of the purposes of morbidity statistics is to correlate rates of sickness of varied severity and duration with social and economic factors which are themselves inextricably bound up with how the subject reacts to sickness, this purpose will be defeated if the illness itself is defined as to severity and duration in terms of the resulting individual reactions to it. For example, a minor illness could be defined as one which did not cause absence from work, but it would then become nothing more than a subdivision in the scale of duration of incapacity.

Durations of sickness also need to be defined in terms of the dates when the subject first became sick and ceased to be sick according to the definition of what constitutes sickness, regardless of the length of absence from work or drawing of sickness benefit. Duration of incapacity and duration of benefit should not be confused in terminology with, and should not be regarded as equivalent to, duration of sickness.

Standardization of terminology is necessary, and WHO is engaged on this task with the co-operation of National Committees on Vital and Health Statistics.

6.4 The community approach

Since we are interested in the morbidity level, not of an individual or a selected group, but of the community as a whole, we must know the number

of those who are "ill" and those who are "not ill" for the purpose of calculating rates, and we must also ascertain the size of the corresponding population exposed to risk of the particular disease. The contention here is that the sick and healthy should add up to the whole exposed population. But if the term "not ill" implies absence of the slightest defect, then perfect health is indeed rare. We are at once faced with the problem of distinguishing degrees of unhealthiness if any useful indices of morbidity are to be obtained. Therefore, instead of being represented in two categories, the state of health of a group of persons may be portrayed more realistically by a continuous scale ranging from perfect health to the complete absence of health, that is, death. Unfortunately there is as yet no agreement on criteria by which the various degrees of ill health between these two extremes may be differentiated. Some critical points on the scale of health which will divide the population into seemingly distinct sub-groups may be selected for practical investigation. But it must not be forgotten that illness rates calculated from these records will depend largely upon the method of differentiation.[1]

6.4.1 *Classification into healthy and sick*

The following five groups, based on the work of Percy Stocks and Harold F. Dorn, may be suggested:

I. Free from any physical or mental defect.

II. Having a congenital defect producing no appreciable disability and not requiring treatment but without sickness as defined in III, IV or V.

III. Carrying scars or deformities left by past illness or injury which do not now cause appreciable disability nor require treatment but without sickness as defined in IV or V.

IV. Affected by latent or incipient disease not yet causing the subject to suffer either symptoms of illness or restriction of activities imposed by its discovery, but without sickness as defined in V.

V. Affected by a disease, ailment or result of injury or by a physical or mental defect, not covered by II, III or IV, including any departure from normal health of which the subject is aware or has been made aware and anything requiring treatment and embracing convalescence after illness or injury.

Groups I-IV may be designated as *healthy* and group V as *sick* for the purpose of statistics. If it is desired to distinguish groups I-IV by descriptive terms, these might be healthy without defect, healthy with abnormality, healthy with scars, healthy with latent disorder.

To give an example, a man found to have a supernumerary rib causing no

[1] Dr.Percy Stocks in his work entitled "Sickness in the Population of England and Wales in 1944-1947", published by the General Register Office as "Studies on Medical and Population Subjects No. 2, 1949", has suggested a classification for this purpose. See also "Methods of measuring incidence or prevalence of disease" by Harold F. Dorn (American Journal of Public Health, 1951, 41, 3, pp. 271-275), and "A Classification System for Morbidity Concepts" by Harold F. Dorn. Public Health Reports Vol. 72, No. 12, December 1957, pp. 1043-1047.

disability and without any other known defect would be in Group II, but if X-rayed and found to have a healed tuberculous lesion he would pass to group III. If later he was found to have a raised blood pressure causing no symptoms and requiring no immediate treatment or restriction of activity he would pass to group IV; and the moment any symptoms of this appeared he would begin to be "sick" (group V).

6.4.2 *Suggestions of WHO Expert Committee on Health Statistics*

The WHO Expert Committee on Health Statistics (Third Report)[1] decided in 1951 not to adopt any narrow or restrictive definition of morbidity statistics and thereby limit the range of its discussion, but rather to take cognizance of any statistics relating to departure from health as defined in the Constitution of the World Health Organization, (see Section 20.4.1).

In December 1956, the WHO Expert Committee on Health Statistics (Fifth Report)[2] stated as follows:

> "Discussing the comparability of the statistical units involved in the compilation of morbidity statistics, the Committee agreed that these units will generally be either "persons", "illnesses" or "spells (or 'episodes' or 'periods') of illness". For instance, one patient may, within a given period of observation, e.g., a year, suffer from illness A twice and from illness B three times. If the spells of illness A and B occur at different times this patient will have contributed one unit to statistics of "persons", two units to statistics of "illness" (i.e., "diagnoses" or "causes of illness") and five units to "spells". The Committee regarded it as essential that in the presentation of morbidity statistics it should be made clear to which of these three concepts of morbidity the statistics actually relate. Furthermore, the items of information upon which morbidity statistics are compiled, in whichever of the above three classes they fall, will relate either to sickness *beginning* within the period of observation, to sickness *ending* during the period, to sickness *current at any time* during the period, to sickness *current at some particular point of time* during the period. Alternatively the statistics may relate to the *duration* of sickness current or ending during the period; these are widely used in the social security field. Great confusion can result from attempts to compare morbidity statistics based on sickness beginning, ending or current within a given period of observation with morbidity statistics in which the aspect of sickness measured is its duration."

In its sixth report[3] the Committee has recommended that the term "incidence" be used to describe the measurement of frequency of illnesses commencing during a defined period and that this term be used with no other connotation. In utilizing the term "incidence" it should be made clear whether the term is used in respect of illnesses or in respect of persons ill. The term "period prevalence" (or, more specifically, annual, monthly,

[1] Expert Committee on Health Statistics. Third Report. World Health Organization Technical Report Series No. 53, Geneva, 1952.
[2] Expert Committee on Health Statistics. Fifth Report. World Health Organization. Technical Report Series No. 133, Geneva, 1957.
[3] Expert Committee on Health Statistics. Sixth Report. World Health Organization Technical Report Series No. 164, Geneva, 1959.

weekly, prevalence) has been recommended for use to describe the measurement of frequency of illnesses in existence at any time during a defined period (i.e. a year, a month, a week etc.) and this term is not to be used with any other connotation. The term "point prevalence" (or, more specifically, the "prevalence" at a stated point in time) has been recommended for use to describe the measurement of frequency of illnesses in existence at a particular point in time. This term also is not to be used with any other connotation.

The Expert Committee on Health Statistics has further recommended "that in any published morbidity statistics the general principle be adopted to indicate clearly:

(a) the purpose of the statistics and the definition of "sickness" employed;
(b) whether the statistics relate to sickness beginning within the period of observation (e.g., incidence), to sickness current during this period ('point prevalence' or 'period prevalence'), or to duration of sickness;
(c) the particular disease or diseases to which the statistics relate;
(d) the particular time at which a period of sickness is regarded as having begun or terminated, e.g., admission to or discharge from hospital, cessation or resumption of work;
(e) the period of observation, e.g., one month, one year;
(f) the denominator, e.g., the population at risk."

6.5 Sources of morbidity statistics

Among the various sources of morbidity statistics at present available in some countries the following are of importance:

1. notifiable disease records;
2. hospital records of in-patients together with records of attendance of outpatients in hospitals, clinics and dispensaries;
3. cases seen by the staff of infant welfare centres, clinics, school medical services, by factory medical staff and other medical staff responsible for special groups of population;
4. medical practitioners' records based on domiciliary visits and patients attending their surgery;
5. records collected during domiciliary visits paid by other health and welfare staff;
6. special sickness surveys covering the whole population or samples of it;
7. statistics on illness collected in connection with life or sickness insurance;
8. medical care statistics, i.e., statistics collected under community medical care programmes;
9. national or local registers on cancer, tuberculosis and Wassermann files;
10. statistics of causes of death in relation to knowledge of duration of illness if recorded;
11. records from industrial sickness benefit associations;

12. records from recruitment to the armed forces or gaol records;
13. mass diagnostic and screening surveys, e.g., tuberculosis, venereal disease.
14. absenteeism and sickness records in educational institutions, civil service examinations, and industrial concerns.[1]

These numerous scattered fragments of statistical information can yield valuable data ranging from detailed information in some cases to moderately detailed knowledge of fairly broad segments of the population.

6.5.1 *Integration of various sources*

What is really needed is the integration of this fragmentary knowledge into an estimate relating to the entire population, not necessarily giving details of each cause of illness, but providing extensive information of a kind that will enable broad statements to be made about the total sickness level. The task is something like that of a map maker who has maps made for small areas by several independent workers, varying in detail and accuracy, overlapping, and not infrequently disagreeing. To combine his sectional maps into a whole, he has to make the greatest possible use of all his previous knowledge, much of which is worth while and consistent. He first of all fixes landmarks for reference points and then proceeds to make a new survey to fill the empty parts of the new map. In the same manner, different sources of statistical information now available give us broad indications of how a comprehensive plan can be drawn up. The major landmarks as it were for our purpose are:

1. monthly rates of incidence of certain well-recognized groups of diseases on which information is already being recorded. This information is available for several population sub-groups by age, ethnic group, sex and geographical sub-regions;
2. the prevalence of chronic diseases for the same categories of age, ethnic group, sex and geographical sub-regions;
3. the amount of time lost from work as a result of total illness by persons in certain industries and the labour force;
4. the number of visits by and visits to a physician.

6.5.2 *Additional sources*

These sources, although valuable, are hardly enough to provide a complete picture. The following methods have been suggested for collecting information on general sickness for the entire population.

1. The insertion of two or three questions in the schedule of the decennial census, as for instance, questions about leprosy, blindness, deaf-mutism. This method has few benefits and many disadvantages, for example:
   (a) the census schedule is generally overloaded;
   (b) the census enumerators cannot easily be given training for eliciting information, because of the technical nature of the definitions;

[1] A fuller list appears in the Third Report of the WHO Expert Committee on Health Statistics, World Health Organization Technical Report Series, No. 53, Geneva, 1952.

(c) the long interval of ten years involved permits far too few details to be collected and makes it impossible to study seasonal and secular changes in the level of morbidity;

(d) there is no opportunity to study the bias introduced in the information thus collected.

2. A supplementary medical report on sickness along with the birth certificate provides a new type of morbidity reporting and is designed to obtain data on diseases and injuries occurring during pregnancy and childbirth. In the United States the record card for collecting additional information was included as optional on the model birth certificate prepared in 1939 and most of the States have already voluntarily added this information. The record card requests information on pregnancy and labour, parturition or instrumental procedures, method of induction of labour, birth injuries, congenital malformations, etc. This method can yield highly valuable records on sickness and reproductive wastage but is successful only if births occur in hospitals or are seen by physicians. It yields valuable information for programme planning, care of premature infants, epidemiological research and case finding, but of course only for childbearing women.

3. As a source of morbidity statistics, the reporting of all cases seen by physicians has been tried on a limited group[1]. The physicians are required to report certain notifiable diseases but it is hardly reasonable to expect each of them to undertake the clerical work of reporting on all the cases treated. The reports filled by them are necessarily incomplete. In the case of chronic diseases the patient may be seen by more than one doctor and there is duplication in reporting.

Moreover, in statistically under-developed areas, the shortage and unequal distribution of medical staff, combined with the inability of a large section of the population to secure medical assistance, add to the impracticability of this method of reporting.

4. The consolidation of information and central reporting on all hospital cases has some advantages, but patients attending hospitals are not generally representative of the sickness picture of the community. The data collected from them are dependent on the method of selection adopted for admission, and on the extent to which hospital facilities are utilized by different sections of the population. Takemune Soda has reported that the estimation of morbid conditions in a community by the patient census in hospitals and clinics has been attempted with some success in Japan[2].

In some countries the difficulty of getting morbidity information from other sources makes the hospital in-patient the most important source of diagnosis at present, in spite of the limitations.

All the same, a morbidity inquiry has been designed to collect information from a number of hospitals in England and Wales to give more information than has been available up till now about sickness and injury treatment in

[1] See "Morbidity Statistics, from General Practice", Volume I (General) by W.P.D. Logan and A. A Cushion. Studies in Medical and Population Subjects. No. 14, 1958.

[2] See: WHO/HS/79 mimeographed document by Takemune Soda, 1956.

hospitals. The hospitals concerned complete the summary sheet in respect of each of their in-patient discharges and send these summaries at intervals to the General Register Office, where the information is consolidated. From this analysis it has been possible to estimate the deaths per 1000 discharges by sex and the nature of the disease, total days in hospital and mean days in hospital. An interesting comparison can be made of the average stay in hospital for all discharges during 1949 i.e., 17.5 days, with the results of a survey in 1867, according to a plan prepared by Florence Nightingale, which showed the mean duration of residence at that time to be 28 days for medical and 32 days for surgical cases. Important information has been collected on the causes of hospitalization, e.g., maternity, neoplasms, injury, and for each disease one can study age distribution, patient days, number of patients dying.

5. The most important, and possibly the only source for securing complete coverage in respect of morbidity statistics is the individual who has fallen ill, or some member of his household. In recent years, without ignoring the other sources of knowledge, attempts to secure information from this source on a nationwide basis have been made, mostly through sickness surveys.

6.6 Sickness or disability surveys

6.6.1 *Types of survey*

Two kinds may be differentiated:

1. *Case-finding surveys*, such as attempts to locate all leprosy patients, persons suffering from tuberculosis, or all blind persons within a given area. The relative infrequency of the cases makes it too expensive to carry out a house-to-house canvass of the whole area; instead, the investigator directs his attention to locating cases, following every clue he can find, but visiting only those households or establishments where there is reason to suspect the presence of a case. In such a survey the investigator uses the population as enumerated or estimated from the census for the calculation of rates. These surveys can never claim to provide complete information.

2. *The house-to-house canvass* of households — that is, a sample of households or of certain blocks, streets, or subdivisions is completely canvassed by visiting every household and asking the same questions about the healthy and the sick. This type of canvass provides the same information about age, sex, occupation, income, etc. for both the healthy and the sick, thus affording data for the computation of rates for any classification that is carried on the schedule. This second type of survey may be divided into two further types, according to the nature of the sickness data collected.

(a) In the *prevalence* survey, each family is asked about illness existing on the day of the enumerator's visit. This method should afford maximum completeness in the recorded data, inasmuch as the housewife is not expected to remember prior illnesses, but those in existence when she is interviewed. If, in addition, the record includes only cases that can be objectively defined such as those causing inability to work or pursue usual duties, the record

should be particularly complete. However, the recorded cases of illness will be heavily weighted by chronic diseases because the chronic case that lasts for a year or more will be present on any day that the enumerator calls, but many minor colds and digestive disturbances that may have occurred within the last few months will be unrecorded because the patient has recovered and is well on the day of the visit. A second difficulty lies in the fact that the amount of illness recorded varies considerably with the season of the year when the survey is made. In actual practice the population is asked about illnesses which occurred during a small defined period irrespective of whether the illness started before or during the period. The presence of all illness during a period is measured by period prevalence rate (see Chapter 17).

(b) In the *incidence* survey, the housewife is asked for a record of illnesses that have occurred during a given period, such as one week, one month, two months, whether or not the person is sick on the day of the canvass. In such a record there is more balance between acute and chronic diseases, inasmuch as the many minor affections of short duration have a place in the record, as well as the chronic ailments that exist on the day of the visit. The disadvantage of this method is that the housewife cannot be expected to remember and report completely on more than a rather short period before the date of the survey. Thus, if one attempts to get a record for a twelve-month period, the illnesses for the earlier months will be less completely reported than those for the months near the date of the visit.One must therefore enquire only about the severe illnesses if one expects the record to be complete for the entire year. To avoid this loss of minor cases in the earlier months, the *periodic incidence survey* has been developed, by which the families are canvassed at fairly frequent intervals, and at each visit a record is made of illnesses that have occurred since the preceding visit. Several studies of this kind have been made with visits at two week to two month intervals. To get a reasonably complete record of minor affections experience suggests that the reports must be secured at intervals of one to two weeks and from the individual concerned rather than from some other informant. The effect of the memory factor has been discussed by W. P. D. Logan and Eileen M. Brooke[1] and P. G. Gray,[2] among others.

[1] The Survey of Sickness 1943 to 1952, by W. P. D. Logan and Eileen M. Brooke. Studies on Medical and Population Subjects No. 12. General Register Office. Her Majesty's Stationery Office, London.

[2] The Memory Factor in Social Surveys, by P. G. Gray. Jour. Amer. Statistical Assoc. June 1955, Vol. 50. p. 344

CHAPTER 7

Family Health Records as a Source of Health Statistics

7.1 Importance of family or household data

Historically, when the emphasis was on the study of vital events such as births, deaths, marriages and divorces — events of legal and social importance to each individual personally, — the record had to be established on an individual basis. The individual records, when assembled for the community as a whole, provided community indices such as birth, death, and infant mortality rates, life tables, and possibly also sickness rates. These indices are used for comparison and interpretation with the object of obtaining diagnostic tests of community health. This is all we have been able to study until now. But these data and indices tell us next to nothing about the family or household as the setting in which the individual events occur — for example, how family health conditions are affected by diet, sanitary facilities, domiciliary health services, or sickness within the family. Many vital events affect the family as a unit (e.g. widowhood, orphanhood), and the family itself has its own effect on vital events (mortality, mental health, etc.)[1].

At one end of the scale we can think of individually reported counts, one or more for each person involved in the vital event. At the other end there could be a single index obtained from all these counts in which the identity of individuals is completely lost. The community, or any other well-defined population group, then becomes the unit of study.

Between these two extremes a relatively new development is taking place as health work expands. This represents the collection of data on a different unit of study — the family or the household, the study of which is increasing in importance until it becomes the *primary* unit of investigation. Margaret Merrell of Johns Hopkins University[2] in developing this concept, stated: "We may think of the public as being composed of persons in an atomic sense. . . the chemist is at times interested in the properties of water as related to those of the hydrogen and oxygen atoms which form it, and at other times he is interested in water as water." So if we compare the community with the

[1] See: Uses of household and family statistics, by Paul C. Glick. Population Index Vol. 23, No. 3, July 1957. Principles applying to the collection of information on health as related to socio-environmental factors, by Lowell J. Reed. Millbank Memorial Fund's Background of Social Medicine, New York, 1949. Profile of the American Family, by E. A. Lew. Metropolitan Life Insurance Co. New York, 1956.

[2] The Family as a Unit in Public Health Research, by M. Merrell, Human Biology, Vol. 24, No. 1, February 1952.

mass of water and the individuals constituting it as atoms, the simile could be extended to bring in another chemical unit, the molecule, corresponding to the family or household.

7.2 Met and unmet needs of the family

The need for maintaining family health records leads us to consider one new and important development. In the past the health officer, when preparing his Annual Report, would of course give a whole catalogue of the various services his Department offered to the community; enumerating the work done by his staff such as so many food samples seized, so many immunizations done, so many visits paid by the nurses, hospital beds available, and so on. But there are two parties to this effort, the giver and the receiver. The health department gives and the family receives. It is all very well for the health officer to say he did this and that for his community, but people are beginning to ask what the community says it actually received. Were the services really given to the needy, or only to some selected population group — chosen perhaps because of special considerations, personal whims of the health officer or his staff, or even just nearness to the health centre? In other words, were these services really given in direct response to the needs? What were the needs of individual families, and to what extent were they actually met in the opinion of the family itself? Obviously, the man who eats the pudding is the one to say how good it is. Hugh Leavell of Harvard has said: "At the beginning of our school year at Harvard I usually walk silently into the classroom and write on the blackboard the question 'What do people want done about their health?' "This has already become a watchword in international health work, when individual countries are asked about the health programme they need. What about determining these needs at the family level? The people themselves must be part of the health team if its work is to be effective.

The emphasis rests on making contact with the household to enquire from the head (usually the housewife) what the actual health needs are, and how far they are being satisfied. Some enlightened health administrators, research institutes, and study groups at the international level, are already urging that studies should be undertaken from the "receiving end". This problem of going to the household and trying to build up a record of their needs and the services provided, has become of great interest partly for the reasons just explained, but even more because of studies initiated by the United Nations, the International Labour Organization and the World Health Organization, in connexion with finding ways and means of establishing an index of standards or levels of living. An index of the cost of living has already been improvised but there is no broad indication of the level of living. We know that the level of living of some populations is higher than that of many others. But how can we compare these levels numerically? The study of this subject has once again brought out the need for pursuing enquiries at the family level: what facilities they have, what they lack, how they live, how they spend their money and leisure time, and meet their basic human needs.

This once more lays stress on the establishment of data for families as units. In fact, a whole science of dealing with family data is growing up and a new name "social biostatistics" has been suggested.

7.3 Need to co-ordinate health services rendered to the family

The health department of today, whether concerned with nutrition, housing, water supply, or its countless other activities, in the first place makes contact with the family or the household, generally through the public health nurse. The family is the focus, and it is there that forms, questionnaires or record cards, are completed. Unhappily, workers in different fields often approach the same family and assemble similar data in different ways. For instance, the maternal and child health service may be asking the family about prenatal and postnatal care to build up its records accordingly. Nutrition workers may be in touch with the same family in connexion with studies on diet or child growth. Epidemiological services may go to the same house to trace cases of disease and investigate the contacts. Sanitary inspectors may be knocking at the same door to enquire about housing conditions or water supply for their separate records, and last of all, the statistician may go to the same house and shyly present an elaborate questionnaire for some new kind of sample survey. It is most annoying to household members if similar questions are asked by different agencies one after another. On one occasion, in a rural area in North Africa, the head of a household had five different house numbers which different agencies of the health department had affixed to the door. The census people had hurriedly marked the house; the DDT team numbered the same house in a different sequence, and then in turn came along the nutritional staff and bilharziasis and tuberculosis investigators. Such unco-ordinated work by different teams or agents of the public health department involves waste of effort and time apart from being irritating to the citizen. Many health departments are today confronted with a multitude of record forms of various designs, sizes, and materials used by different services. The time is overdue when a unified family record from the very start should be created. Indeed, many health departments are being forced to reorganize their entire statistical system by using the family or the household as the unit for maintaining records.

7.4 The family physician and the public health nurse

For the medical profession the family is in most cases the centre of interest, as is shown by the well known term "family doctor". An experienced general practitioner can call upon his first-hand knowledge of social, economic and cultural conditions and apply that knowledge to both diagnosis and treatment. The closest family connexion in the health service is the public health nurse, who gains intimate knowledge of the family through her domiciliary visits. She knows that health, sickness and recovery occur in the family context; and she therefore takes stock of the economic situation and other factors involving the family as a unit. Her methods have been mostly rule of thumb based on the impressions from her own experience. Of course,

lack of reliable statistical data on the family as a unit has not prevented her from doing an effective job any more than want of mortality and morbidity data prevented good work by the physician and the health officer half a century ago. All the same, no one likes to work in the dark, and the changing picture of disease bringing to light chronic cases and mental disorders and so on means today that the same family or household data have to be made available to a variety of health workers. If such data existed, the nurse and other members of the health profession would learn to use the material and come to rely on it. In addition sociologists, psychologists and others would profit from this essential knowledge of the family, provided the confidential nature of the information was preserved. The wide spectrum of the health services requiring family records includes data on tuberculosis and infectious diseases that are dealt with in the same way, and also many non-infectious ailments such as asthma, hypertension and cardiovascular diseases, all of which might well be influenced by the family situation. Indeed, the idea of disease as an entity limited to a single person fades into the background, and disease recording becomes an essential part of the continuous process of family living.

7.5 The household as a unit for morbidity studies

In a study of health statistics we are no longer satisfied merely with death records but wish to learn how fit and healthy the living population is. Sickness statistics, which are the obverse of this, are a developing field of study today. The most important point is that in the study of morbidity no other system of continuous sickness recording has yet been found practicable except that of visiting the household and maintaining data on a household basis. Incidentally, the unit of study makes it possible to link morbidity data to a variety of social and economic conditions. What is more important, not only sickness experience but also invalidity and disability, impairment and injuries in the population can be studied; and by this means one can find out the amount and kind of medical care received and the cost of treatment.[1]

7.6 Mental ill health and the family

The modern menace of increasing mental ill health points to the need for statistics related to the family structure. As Halbert L. Dunn and M. Gilbert[2] have said: "The Family is the setting for the most intense emotional experience which the individual has in the course of a lifetime. Birth, puberty, marriage and death are family experiences. The family is the source of serene security, of anguished insecurity, of love and hate, of pride and shame, of ecstasy and anguish." It is small wonder that family dramas and crises have a profound effect on the course of health and disease. The causes of overcrowded child-guidance clinics are being sought today in the family. Many

[1] Methodology of a family health study, by C. F. Muller, A. Wayburn and E. R. Weinman. Public Health Reports. Vo. 67, No. 11, 1952, pp. 1149-1156.

[2] Public Health begins in the Family, by Halbert L. Dunn and M. Gilbert. Public Health Reports, Vol. 71, No. 10, October 1956, pages 1002-1010.

maladjusted reactions even of adults — the chronic fatigue or neurasthenic symptoms, the psychosomatic neuroses such as peptic ulcer and other ills that the mind is heir to, — are being traced to disordered patterns developed in childhood.

7.7 Advantages of family or household health data

Before proceeding further, we may briefly summarize the advantages of family health record.

(a) It eliminates duplication of effort by economizing on home visits.
(b) It integrates the work of different divisions, ensuring better domiciliary health, medical and nursing services offered by various sections of the health department.
(c) It improves case finding.
(d) It ensures continuity of health work.
(e) It increases public confidence in the activities of the health department.
(f) From the statistical point of view it makes available in one place all the needed information on public health and household studies.
(g) It provides a reliable population base for calculating various health statistics, i.e. the total population exposed to various risks is automatically defined.
(h) It provides the health officer with the necessary background information for estimating family needs as well as providing answers to a variety of practical administrative or scientific questions.
(i) With a record for each family it enables sampling surveys to be carried out on a family basis in connexion with the social, economic, medical, nursing or epidemiological problems.
(j) It enables the health worker to estimate the degree to which the health needs of the community are actually fulfilled.
(k) It enables other agencies engaged in family studies to co-ordinate their findings with those of the health workers.
(l) It enables data on sickness to be satisfactorily collected and offers possibilities of linking data on total sickness to a variety of social and economic conditions.

In view of all these advantages there is good reason why a sound, co-ordinated, statistical record should be maintained in a suitable form for individual households or families. The family, as the most important social institution, has already been intensively studied by sociologists and anthropologists. It has not yet been so well studied by public health agencies; and yet the one agency in direct and continuous contact with families is the health department, the public health nurse being the link. The health department is therefore in the best position to institute family health records and to maintain them continuously. Other interested workers such as sociologists, anthropologists and economists will then turn to the health department for its basic data and on their part will be able to help the health officer with their findings.

In April, 1956, the Eastern States Health Education Conference at the New York Academy of Medicine discussed several points about the family as a focal point for health services. The full text of these papers is being published by the Academy under the editorship of Iago Galdston.[1]

For countries without complete health statistics, household data may well be the only quick, reliable and practical method of obtaining information on levels of ill health. Further, in these countries household health records may well alter radically the national recording systems so that they will follow a new process of evolution. Indeed, the expanding public health activities serve admirably to facilitate the future collection of data with the household as basis.

7.8 Technical and administrative considerations

7.8.1 *Definition of household*

In the first place, if we have to maintain a separate set of records for each individual household or family, we should be clear as to what precisely is meant by this unit. So far, the terms "household" and "family" have been used as if they were interchangeable, but of course they are not. A family connotes a unit comprising two or more persons related by blood, marriage or adoption and residing together. A household on the other hand is a more comprehensive term and may include both related or unrelated persons who live in the same dwelling unit. In the U.N. Principles and Recommendations for National Population Censuses distinction is made as follows between two classes of households, viz. private and institutional:

> "A private household should preferably be defined as (a) *one-person household*: a person who lives alone in a separate *housing unit* or who as a lodger, occupies a separate room or rooms in a part of a housing unit but does not join with any of the other occupants of the housing unit to form part of a multi-person household as defined below; or (b) *multi-person household*: a group of two or more persons who combine to occupy the whole or part of a housing unit and to provide themselves with food or other essentials for living. The group may pool their incomes and have a common budget to a greater or lesser extent. The group may be composed of related persons only or of unrelated persons or of a combination of both, including boarders but excluding lodgers. (For the definition of a housing unit see United Nations document *General Principles for a Housing Census* — ST/STAT/Series M. No. 28.)"

"*Institutional households* comprise groups of persons living in schools and colleges, penal establishments, hospitals, military installations, hotels, boarding houses, etc. Households in which the number of boarders and lodgers exceeds five should be considered as boarding or lodging houses and enumerated as institutional households. The households of institutional directors and administrative personnel with separate living quarters should be considered as private households."

[1] See: Public Health Reports, Vol. 71, No. 10, Oct. 1956, pp. 1011-1031. Sir James Spence's data on "A thousand families in Newcastle-upon-Tyne" are also very interesting.

7.8.2 *Household list and its periodic revision*

It is necessary to list all the households so that each is given a permanent serial number for identification. In many parts of the world housing units have already been allotted permanent serial numbers which are the basis of their postal address. The statistical household number might well correspond to the house number. It should be the responsibility of the statistician to ensure that the household list is kept up to date and that appropriate changes are made after a household has moved. This constantly revised list should show separately the code number of the household, the name of the head, the address and possibly the number of members in the household. A copy of this list should be available to all professional health staff so that they can use the same code number in connexion with their own work.

7.8.3 *Collaboration of the public health nurse and other health staff*

The statistician works closely with the public health nurse to arrange the collection of household data although he plays the dominant role in their interpretation. All health workers should be made aware of the existence of the household lists and of records up to date. At the end of each year these records are revised by the statistical staff and the public health nurse is asked to visit the households where some doubt or difficulty arises.

7.8.4 *Classification of households*

As soon as we think of households as units the problem of classifying them into groups presents itself. One of the simplest methods is of course based on the size of the household but there are many other features which may be relevant: for instance the study may refer to social statistics, housing conditions, (water supply etc.), dietary habits, ethnic origin, and many other factors of this kind.

7.9 Design of the household card: methodology of household studies

What should be the design, content and layout of the household card? An interesting experiment of this kind was the family booklet "Health Record Day by Day".[1] This was divided into seven sections:

1. *Family List:* Demographic and social data, age, sex, relation to head of family, marital status, employment, health insurance coverage, existence of personal or family physician.
2. *General health problems:* Underlying illnesses and impairments, chronic complaints, dental and visual defects, partial incapacities.
3. *Health insurance coverage:* Plan, duration, premium cost, type of benefit.
4. *Immunizations:* Past immunizations, only for children under 10 years.
5. *Daily record of illnesses, injuries and disabilities, and of services received:* A separate page for each family member under proper dates, check-marks in appropriate boxes, indicating days ill, disabled, care received at home, office, clinic, hospital, diagnosis, reasons for visit, preventive, diagnostic or therapeutic procedures.

[1] Methodology of a family health study. See Section 7.5.

6. *Monthly record of expenses for health services:* family expenditure, professional fees, hospital charges, drugs, supplies, laboratory and X-ray charges, health insurance premiums.
7. *Monthly expenses for persons not on family list: i.e.* expenses for relatives in institutions, or others not living in the household.

The advantages of the booklet are that it provides a comprehensive array of designated items which encourages complete reporting. The daily checkmark system makes recording very easy. The book should have an attractive design which makes it readily accepted as a family document (like the old family album).

Family records are being maintained in various places. At the same time attempts are being made to standardize definitions and methodology for collecting information. Additional items on which information could be maintained on a household basis would be:

Health statistics, pregnancies, abortions or stillbirths, live births, foetal deaths, antenatal service, natal and postnatal care received, complications of pregnancy, deaths by age, sex, cause, and medical attention utilized.

Diet and nutrition: Main food habits, types of food consumed, if possible amounts of important foods, infant feeding, including duration of breast feeding, availability of "protective" foods, and kitchen facilities, use of alcohol, nutritional status of members of the family and any deficiency diseases, any guidance received, and from where.

Housing: Type of house occupied with facilities for cooking, toilet, washing, heating, lighting and ventilation, water supply, sewage, waste disposal, prevalence of insects, rats, etc., overcrowding, number of rooms, ownership, place for domestic animals, cattle, etc.

Economic level: Estimated amount and sources of annual income from land, labour, handicraft or other home enterprises, expenditure on food, housing, clothing, medical and health services, etc. social insurance, savings, indebtedness, etc.

Participation in social security schemes, health insurance, social welfare services, or other financial help, participation in social activities.

Participation in health work: Public bodies, voluntary (private) health activities.

Such data could best be collected by trained public health nurses who are acquainted with the households and are therefore also in the best position to educate the community in the value and importance of maintaining such information. The co-operation of the public health nurses is all the more necessary because many items of information are of a personal or confidential nature. For instance, economic level is difficult to estimate, because many people do not like to give an exact account of their income, and being apprehensive of taxation make an underestimate. In some enquiries, an expert is asked to assess the rent of the house, and on the basis of that figure, to classify the households into a few broad categories of economic level. Provision is also made for investigators' assessment of income and also

whether the household was receiving financial assistance. These headings will no doubt have to be varied according to local conditions, especially when recording details of occupation, housing, and sanitation.

7.9.1 *Household and individual schedules*

Two sets of schedules are generally used, one for the household and the other, the individual schedule, to record information separately about each member, especially morbidity data on a continuing basis. Experience shows that since individuals at various ages present different health problems, special provision has to be made for recording various kinds of information. For instance, for women passing through the reproductive age data are needed on pregnancy history. For children under two years one makes notes about weaning, feeds, and immunizations; for children above two years — growth, immunization, school health and so on. Accordingly, although the basic individual schedule may be the same, it could be differentiated further by these categories.

The schedule should be designed so that the information could be sorted and tabulated by machinery. It is also prepared (pre-coded) in such a way that the investigator has very little writing to do; his only duty for most items is to mark the appropriate category. In case numerical information has to be recorded, suitable square blocks are provided. It is only for very few items that a description has to be written out. Some of the items of information from the household schedule are repeated for convenience on the individual schedule, thus providing for an analysis of the morbidity record by certain environmental and social factors. Additional cross classification could be done mechanically with the common household and individual code numbers.

7.9.2 *Manual of Instructions*

A Manual of Instructions should be prepared for the investigators. It is essential that all the points likely to crop up in the minds of the nurses should be thought out in advance and answered in a Manual of this kind. It also forms the material for training field staff. An important point to emphasize is that a Manual of Instructions should be prepared whenever any card is designed for use. It can be kept under continuous revision as new questions, doubts or problems are brought to light in actual practice.

II. HEALTH STATISTICS ADMINISTRATION

CHAPTER 8

Health Statistics and the World

8.1 International collaboration in health statistical work

Collaboration in health statistical work at the international level started over a century ago and spread into many branches. It was nurtured in the past by the International Statistical Institute of the Hague, the League of Red Cross Societies, Geneva, the Office International d'Hygiène Publique, Paris, the League of Nations Health Organization, Geneva, the United Nations Relief and Rehabilitation Administration and now largely by the United Nations and the World Health Organization. International collaboration has taken cognizance of the need to secure comparability of terminology, classification, definitions and methods employed in the collection, analysis and presentation of health statistics. One of its aims is to promote health statistical services to cover all parts of the world and to enlarge their scope. National health administrations whose health statistics are incomplete are encouraged and assisted to create systems of reporting and registration. By this means statistics will achieve coherence in meaning and increase their usefulness to health administrations all over the world. Much remains to be done in securing further comparability of the material collected and in establishing improved systems of collection. Nevertheless, world health statistics are already a basis for vigorous and wholesome international life, and there is a steady flow of valuable information from various parts of the world. It is by the joint efforts of workers at the local, national and international levels that we shall be able to obtain a complete accountancy of health work.

8.2 Statistical work of the United Nations

The role of statistics in dealing with international problems, including health, was recognized at an early stage by those who created the United Nations and the several Specialized Agencies. This was shown clearly by the early provisions of the Statistical Commission within the framework of the United Nations and of a Statistical Office within the Secretariat to serve the needs of all departments and organs of the United Nations. The Statistical Commission assists in promoting the development of national statistics and the improvement of their comparability; in the co-ordination of statistical work of Specialized Agencies; in the development of the central statistical services of the UN Secretariat; in advising the organs of the United Nations on general questions relating to the collection, interpretation and dissemination of statistical information, and in promoting the improvement of statis-

tics and statistical methods generally. Much of the work of the UN Statistical Commission is advisory in character. The recommendations it makes, when accepted by the UN Economic and Social Council, are transmitted to national governments.

The principal functions of the Statistical Office of the United Nations are to collect, analyse and evaluate the statistics from member Governments, Specialized Agencies and other sources; to publish statistics; to co-ordinate the statistical activities of the Specialized Agencies; to promote the development and improvement of statistics in general; to maintain an international centre of statistics, and to maintain close contact with national governments on programmes of statistical research, submission of statistical data, analysis and publication.

The Statistical Office of the United Nations thus has the major responsibility for international work in the fields of population data and vital and social statistics, and the World Health Organization the major responsibility for the wide range of medical and health statistics including the specialized and detailed aspects of cause of death statistics. The Statistical Office endeavours to obtain all statistical publications of national governments. Information not obtainable through published sources is obtained by ad hoc questionnaires.

The Statistical Office publishes official national statistics. It issues a number of publications to provide general purpose data on as many countries and territories as possible, covering the most important economic and social problems. These publications serve the needs of national governments for current statistics on conditions in other countries, as well as fulfilling the many needs of international organizations. A wide range of economic and social subjects including population, vital events, national income, trade, industrial production, wholesale prices, finance and transport, are covered by the UN Statistical Year Books and the Monthly Bulletin of Statistics. For a health worker, more detailed information on population and vital statistics is provided by:

Demographic Yearbook. This is a comprehensive collection of international demographic statistics. Annual volumes present the latest available figures as well as retrospective data on population, births, deaths, marriages, life-expectancy, cause of death, etc. for the major countries and territories of the world. It serves as the central source of demographic data.

A distinctive feature of this series is that in addition to the usual demographic tables each volume deals with a special topic in greater detail:

Year	*Special topic*
1948	General demography
1949-50	Natality statistics
1951	Mortality statistics
1952	Population distribution
1953	General demography
1954	Natality statistics
1955	Population censuses
1956	Ethnic and economic characteristics
1957	Mortality statistics
1958	Marriage and divorce statistics

Some of the data assembled for the Demographic Yearbook are reprinted by WHO in the Annual Epidemiological and Vital Statistics so as

to be readily accessible to the medical and public health professions.

Population and Vital Statistics Reports, a quarterly publication presenting the latest census results, official population estimates, and the most recent statistics on live births, deaths and infant deaths, for over 200 geographic areas of the world.

Population Bulletin, containing articles on demographic and health matters.

Statistical papers and technical manuals, dealing with results of demographic and social studies, reports on statistical activities or with advances in methodology. A list of these publications is given in Appendix I of this book. Of special importance to a health statistician are the principles and manuals on methods, viz:

Principles for a Vital Statistics System, (ST/STAT/SER.M/19)

Principles and Recommendations for National Population Censuses, (ST/STAT/SER.M/27)

General Principles for a Housing Census, (ST/STAT/SER. M/28)

Handbook of Population Census Methods (in three volumes), (ST/STAT/SER. F/5 REV. 1)

Handbook of Vital Statistics Methods, (ST/STAT/SER. F/7)

Handbook of Statistical Organization, (ST/STAT/SER. F/6)

The principles constitute the foundations for United Nations activities in collecting data and in promoting their general improvement. Even though they are not mandatory they represent a world concensus of opinion on what is scientifically sound and administratively feasible. The series of manuals or handbooks further assist the countries in the improvement of statistics. A systematic analysis of the availability and quality of population estimates and birth and death statistics has been published in Demographic Yearbooks.

Considered together, the publications of the United Nations and the World Health Organization (Section 8.3.2) cover the essential statistics on population, vital events and health.

In connexion with the improvement of statistics and their international comparability, the United Nations is engaged in the task of securing agreement among countries on uniform definitions and concepts, promoting standardized practices for collection and publication of data. Examples of these are recommendations on population census data, national income, international trade and transport. The Statistical Office serves as a clearing house for information and expert advice on statistical methods, and aims at ensuring international comparability. Notable contributions to the preparation of the "Principles" have already been mentioned. Assistance is also given to countries in the form of guides, manuals and statistical classifications as well as by means of fellowships, arranging meetings of statisticians, and by organizing training courses. etc.[1]

[1] See: The Statistical Series of the United Nations Agencies, by W. R. Leonard. Report and Proceedings of the United Nations International Seminar on Statistical Organization ST/STAT/SER.M/16, pp. 36-41.

8.3 Health statistical work of the World Health Organization

The World Health Organization has an important function in co-ordinating and directing health statistics at the international level.

Unlike a country that can make laws and has the power and authority to impose them, WHO has no authority except its own standing. If, however, the representatives of various countries assembled in the annual World Health Assembly resolve on certain procedures for adoption by their countries, they do not require express government ratification in every case. When the Constitution of the World Health Organization was ratified, Member Countries agreed that in respect of certain items WHO could make "Regulations" which would automatically come into force for all members without the need for ratification. If a country cannot accept a Regulation, it notifies the Organization before a certain date. For instance, in 1948, the World Health Assembly adopted Regulations on the use of the International Statistical Classification of Diseases, Injuries and Causes of Death, and stipulated standard procedures for the compilation, tabulation and publication of these statistics. These became obligatory, but if any government considered that there was not enough medical staff to carry this out, it would make reservations such as applying the Regulations in certain areas only. In any case, the Regulations become law in each country. Health statisticians observe with pride that the "first international law" in history passed by the World Health Organization related to their own subject, providing for the first time a single comprehensive list of diseases, injuries and causes of death. In 1956 the Regulations were amended.[1]

8.3.1 *Importance of health statistics in WHO*

In addition to passing World Health Regulations No. 1, the First World Health Assembly established an Expert Committee on Health Statistics to act as an advisory body to the Organization. The Second Assembly in 1949 emphasized that in field and laboratory investigations and action carried out by WHO or with its assistance, should make full use of statistics and modern statistical methods in planning and executing investigations and evaluating results. In 1951 the Assembly resolved that one of the aims of the Organization should be to build up gradually at headquarters a body of statistical information covering all parts of the world and encourage branches and regions to make full use of statistical data and facilities.

Following the lead thus given, WHO acts as a directing and co-ordinating agency in health statistics. One of the most urgent questions is to secure adequate and comparable statistics of morbidity. A morbidity conference arranged by WHO in Geneva in November 1951 of experts drawn from several countries gave further evidence of its interest, (see Section 6.4.2).

Other subjects recognized as needing special attention are:

[1] The Seventh Revision of the International Classification of Diseases and the Amended Regulations have been published by WHO in the Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death, Vols. 1 and 2, Geneva, 1957.

1. advancement of statistical methodology and definitions through its Expert Committee;
2. training of statistical personnel to equip national health administrations by means of training courses, seminars and fellowship programmes;
3. holding international conferences of workers in vital and health statistics;
4. introducing statistics as a subject into medical schools and training auxiliary public health personnel;
5. sending consultants and advisers to different countries to assist national governments in developing their health statistics services.

8.3.2 *Publication programme of WHO*

Among some fifteen types of technical publications and scientific works issued, those of statistical interest and importance are:

1. The monthly Bulletin of WHO, containing articles on the latest medical and scientific progress in health. One issue of the Bulletin[1] was devoted to health statistics.
2. The monthly Chronicle of WHO which reviews its various scientific activities and provides summaries of recommendations and resolutions.
3. The quarterly International Digest of Health Legislation, in which national legislation relating to health statistics is reported from time to time.
4. The Technical Report Series, containing reports of expert committees on various subjects[2].
5. The Annual Epidemiological and Vital Statistics, in which annual figures from 1939 have been published.
6. The monthly Epidemiological and Vital Statistics Report.
7. The Weekly Epidemiological Record.
8. The Annual Report of the Director-General which includes an account of statistical activities.

8.3.3 *Expert Committees on Health Statistics and other subjects*

The number of specialized subjects with which WHO has to deal and the constant advances in scientific knowledge have led it to appoint committees of experts drawn from all over the world. The functions of these committees are to take stock of the latest expert information, to formulate technical recommendations which take into account opinions and practices in different countries, and to make recommendations on research. A number of statistical points have been discussed by Committees dealing with special health subjects.[3]

The Expert Committee on Health Statistics was established in 1948 and

[1] Bulletin of the World Health Organization, 1954, 11, Nos. 1-2.

[2] The reports of the Expert Committee on Health Statistics have appeared in the series as Nos. 5, 25, 53, 133 and 164, and the Report of the International Conference of National Committees on Vital and Health Statistics held in London in 1953 as No. 85.

[3] For purposes of quick reference see Appendix II, indicating the statistical points covered in respect of any special health field and the corresponding reference to the WHO Technical Report Series.

meets at two-year intervals. Its subcommittees have reported on the definition of stillbirth, cancer statistics, and hospital statistics.

8.3.4 *National Committees on Vital and Health Statistics*

In April 1948, at the International Conference convened in Paris for the Sixth Decennial Revision of the International Lists of Diseases, Injuries and Causes of Death, a plan was put forward to encourage statistical work at national and international levels. It was suggested that in each country a National Committee on Vital and Health Statistics be created. This idea was prompted by the needs of health organizations to obtain reliable and comparable statistical data and to improve their own machinery. The conference recommended that the national committees should study the production of satisfactory national and international statistics including health statistics relating to family structure and to the socio-economic and occupational background of the individual; that in countries facing population pressure, tropical diseases or malnutrition, they pay particular attention to the statistics needed for these problems, and co-operate with schools of medicine and public health in promoting education and training in vital and health statistics.

A report of the London International Conference of National Committees on Vital and Health Statistics held in 1953 states the objectives, functions and constitution of these committees. A new kind of international activity has been generated through these National Committees, and much work has already been done. For instance, the United States National Committee on Vital and Health Statistics has studied and reported on important topics such as foetal death, fertility and population estimates, and national statistics requirements.

Other activities of the United States National Committee include classification of physical impairments, hospital morbidity statistics, national morbidity surveys, code of surgical operations and an adaptation of the International Classification of Diseases to the needs of the Armed Forces.

Contributions have similarly been made by the National Committees of the United Kingdom, France, and certain other countries.

8.3.5 *Epidemiological intelligence services*

In a world in which modern means of travel can so swiftly convey man and his diseases from one country to another, some form of international warning system and control of traffic is essential. We frequently say that the world has shrunk today, shrunk in the sense that innumerable infected zones lie at the very doorstep of what were thought to be isolated safe areas. In fact a person can now fly round the world in less time than the incubation period of many diseases.

WHO's main concern has been to devise internationally agreed sanitary regulations to provide for maximum safety to all countries and at the same time allow freedom of movement for individuals, cargo and air freight. Through a series of conferences the conflicting interests of different coun-

tries have been resolved and sometimes rigid restrictions on travellers have been removed. WHO has succeeded in establishing International Sanitary Regulations on a generally agreed basis to secure health safeguards permitting the widest possible freedom to travellers. These are incorporated in WHO Regulations No. 2 — "International Sanitary Regulations". The six diseases requiring international control and termed "quarantinable" are plague, cholera, yellow fever, smallpox, typhus and relapsing fever (see Section 5.4.4).

Under these Regulations each health administration notifies WHO by telegram within twenty-four hours of being informed that an area has become infected; the existence of a disease so notified has to be confirmed as soon as possible by laboratory methods within the resources of the country. This information is later supplemented by information as to the source, the type of the disease, the number of cases and deaths, the conditions affecting the spread and the prophylactic measures undertaken. In the case of rodent plague, notification of a disease is supplemented by monthly reports on the number of rodents examined and the number found infected. During an epidemic this information would be followed by communications to WHO as frequently as possible. The number of cases and deaths would be sent in at least once a week. The precautions taken to prevent the spread of the disease to other territories through ships, aircraft, trains or road vehicles leaving the infected local area, would also be stated. In the case of plague the measures taken against rodents would be specified. For quarantinable diseases transmitted by insect vectors the measures taken against such vectors would also be stated.

Each health administration is also required to send to WHO at weekly intervals:

(a) a report by telegram of the number of cases of the quarantinable diseases and deaths therefrom during the previous week in each of its towns and cities adjacent to a port or an airport;

(b) a report by airmail on the absence of such cases.

Similar notifications are to be sent by each health administration, on request, to any diplomatic mission or consulate established in the territory for which it is responsible.

WHO on its part is required to send to all health administrations as soon as possible and by the means appropriate to the circumstances, all epidemiological and other information which it has received from the health administrations as well as information on the lack of any return required under the Regulation. Urgent communications are to be sent by telegram or telephone; in exceptional urgency where there is risk of the spread of a quarantinable disease the highest priority is given to telegrams and telephone calls under international telecommunication agreements. At the end of each year health administrations are required to forward to WHO information about the occurrence of any case of a quarantinable disease due to or carried by international traffic and on the action taken under these regulations. On the basis of the information so received an annual report is prepared on the functioning of these regulations and their effect on international traffic.

In fact three types of information are being received by WHO: first a preliminary report which includes reports even of suspected cases. These may indicate the occurrence of first cases only. Then follows a weekly report of provisional figures which the health services of the area can quickly assemble. This report relates to a week ending Saturday and has to be despatched by the health administration immediately after the end of the week. The third report gives final figures which include belated omissions and excludes cases later found not to be of the disease.

The task of WHO is to provide all the countries with the information it receives by the quickest possible route. Full use is made of the modern means of distributing this information by telegram to countries in close relationship with infected areas and regularly by weekly and daily radio broadcasts. An extensive network of radio broadcasts has been set up to disseminate information to countries and ships at sea. In order to achieve greater precision in the radio messages and to reduce cost, messages are generally transmitted in code — the Codepid.

A watch is also kept on the weekly progress of other infectious diseases in case they become epidemic in any country and spread to other areas. Some countries send WHO weekly information for as many as forty infectious diseases; others send only for a few, owing to lack of facilities for notification. Up-to-date information on cards is maintained separately for each country and for each infectious disease. The week-to-week compilation of figures on the same card for a long period indicates where any abnormality in incidence is taking place. As soon as an increase is apprehended, wide publicity through weekly epidemiological notes and separate press reports is given. Thus short notes on various diseases, (influenza, smallpox, poliomyelitis, etc.) are published in the Weekly Epidemiological Record.

In a series of studies conducted from time to time the figures for a large number of previous years are put together and published for comparative purposes in the monthly Epidemiological and Vital Statistics Report. The monthly WHO Epidemiological and Vital Statistics series may be regarded as a continuation of the epidemiological report of the League of Nations Health Organisation and of the statistical part of the monthly bulletin of the Office International d'Hygiène Publique and the epidemiological information bulletin of UNRRA. It contains figures of cases of and deaths from the more important communicable diseases by countries.

As early as 1923 health administrations felt the need for more comprehensive, detailed and reliable statistics on communicable diseases. Accordingly the League of Nations issued annual volumes of corrected statistics on communicable diseases in the "Annual Epidemiological Record". During the war years the printing of this volume was interrupted. WHO has continued the publication of these data from 1939 onwards on an annual basis in the Annual Epidemiological and Vital Statistics.

8.4 Use of epidemiological information

Information on epidemic diseases is used freely by health administrations

in their day-to-day tasks and also by epidemiologists and other scientific workers for the study of factors that lead to epidemics. Studies are also made of seasonal variation as well as cyclical and long-term trends. Some try to correlate variation in disease prevalence with climatic and other factors. Health administrations are interested in correlating variations in disease with the control measures they adopt, immunizations, hospital care or quarantine restrictions.

The reliability of data depends on how they are collected. One must bear in mind that through lapse of time the definitions and the mode of classification of different diseases may change. When figures published by international agencies are studied over a series of years, it is necessary to make sure that they are comparable in regard to definitions or mode of classification used and the population covered. Adjustments should also be made for the size of the population or area covered. Sometimes territorial changes between two countries or areas produce a break in the series and this must be kept in mind. When figures are collected from a large number of countries there is always the risk of heterogeneity introduced by varying conditions of collection, diagnosis and definitions. The figures printed by any international organization cannot therefore be taken merely on trust. A correct understanding of the background of collection of these figures is a pre-requisite for drawing reliable conclusions from the data.

CHAPTER 9

Health Statistics Legislation

9.1 Necessity for legal authority

Legal authority is indispensable for the collection and publication of national health statistics. Otherwise there would be no obligation on public and private institutions or on individuals to furnish the information required, especially if some part of it were confidential. An even greater difficulty arises if members of the public suspect that the information may affect them adversely in taxation, conscription or other matters of this kind. No organized society can rely solely on the voluntary co-operation of citizens in supplying statistical information.

There are many technical reasons in addition why the support of legal authority is essential from the very beginning of the scheme. Uniformity throughout a country or region is indispensable for accurate collection and recording of statistical material, and the law can also secure conformity in prescribing standards for this purpose. In the second place, proper legal authority is required for laying down a definite plan for the organization, that is, to prescribe the reporting intervals, and the general form and scope of vital and health statistical policy in a country. Statutory authority is also necessary for setting up the machinery of collection which includes registration centres and the responsibility of properly appointed persons to undertake the work. The obligation on the public to furnish information can only be effectively secured in law by fixing penalties for non-compliance. Legislation may also be required which affects statistical work indirectly, as for instance the occupational health of miners, factory workers and other persons in employment.

9.2 The principles of statistical legislation

Legal systems and practices follow a great variety of patterns in different countries and the authority of legislative bodies varies from one country to another. There are nevertheless certain basic principles. The application of these principles must be varied to meet different local situations, economic and social backgrounds. The main features are that legislation should give a proper form to the vital and health statistical policy of a country and it must also protect both institutions and individuals against improper use of information furnished in confidence. The following are the main guiding principles of legislation:

(a) It should be adequate to meet every likely situation as well as being direct and to the purpose.

(b) It should be practical in its application at all stages in relation to the resources of the area. For instance, it would not be practical to have the cause of death medically certified where there were not enough doctors to do it.
(c) It should create a public duty partly through education and partly by recourse to compulsion as a last resort.
(d) It should take account of public opinion, traditions and cultural developments.
(e) Like all legislation, it must conform to the country's constitutional system and be co-ordinated with existing statistical laws.
(f) It is important that legislation should not lag behind modern technical knowledge, but amendments for this purpose can generally be dealt with as occasion arises by means of regulations prescribed under the enabling statute.

The pattern of legislation within the terms of these principles has some special features. Statutes usually contain self-executing sections which impose an obligation with appropriate sanctions for non-compliance. There are also, in many statutes, other sections in which a broad general obligation is laid down but authority is delegated to a Minister or statutory authority to determine the exact manner in which the statute will be applied, so as to meet the needs of local conditions or to select certain items and omit or postpone the operation of others. The self-executing sections do not cover all the details of organization. Some must be left for subsequent regulations or administrative action under the broad provisions of the statute. To take a simple example, it is obligatory to record vital events like birth or death, but permissive to include certain further items of information such as ethnic group of the parents or the occupation of the father. Every section of the law should be considered from the long-term point of view so that it will meet the needs of constantly changing conditions. For this reason the statute should not be too detailed; it should leave actual procedure to the discretion of the department concerned. This would permit flexibility in the maintenance of the series, and enable the statistician to start the collection of new data or discard an obsolete series.

9.3 The drafting of legislation

The drafting of legislation is a science requiring special legal experience and it is generally undertaken by a department of government set up for the purpose. The object of drafting is to write a law which is clear in intention, precise in its application, in full conformity with other legislation, and generally capable of enforcement. That is why drafting is entrusted to the legislative branch of government. Nevertheless, in permanent statute law and particularly in a subject requiring periodic activity such as the taking of census and other activities in collecting statistical information, it is essential that the law should permit of minor adjustments from time to time according to requirements. Plato,[1] many centuries ago, recognized this difficulty and

[1] Laws VI, 772B.

set it out with his usual skill: "In all matters involving a mass of petty detail the lawgiver must leave gaps; rules and up to date amendments must be made from year to year by persons who have constant experience in these matters and who become expert in practice so that a satisfactory code is finally agreed upon to regulate these principles." In other words, the law has to be operated by the statistician in an administrative department and it is essential to secure flexibility and practicability. The statistician has to explain the need for certain requirements and the methods by which the statistical laws are put into operation. It is therefore necessary that he should be called in for consultations at the earliest possible moment during the drafting stage. Through this collaboration between the legal draftsman and the statistician a statute can be created which will stand the test of practice, meet the inevitable changes brought about by time, satisfy the needs of the health service, and at the same time impose no hardship on the citizen.

An essential factor in drafting statutes is that the technical terms should be clearly defined. Failure to do this has led to considerable difficulties in application and it obscures the interpretation of the law especially where action is required. With a view to ensuring both national and international comparability a large number of definitions have already been standardized; these include the definition of live birth, death and foetal death, and some of these are obligatory. Any requirements which are made obligatory should of course be contained in the statute and not in administrative regulations. On the other hand certain additional powers can readily be given to local authorities by means of subordinate legislation such as a by-law. The Minister himself may be given power to conduct surveys or statistical investigations as he deems necessary. He may be authorized to delegate his powers in this respect to a scientific body such as a research committee.

9.4 Contents of the draft

It is not possible to suggest a single model of contents because of the great variations between one country and another. The experience of a number of countries is nevertheless of value especially when it reflects the organization of statistical services which have already been working for a considerable period. In spite of the variety of legal systems, practices and terminology, a comparative examination of law enabled the United Nations to provide a convenient checklist.[1] This gives the elements of statistical legislation to serve as a guide for countries which might wish to introduce a new system or to revise their existing laws. The checklist also prescribes financial and budgetary arrangements for maintenance, recruitment and management of staff and for other matters essential to the operation of the statistical service.

[1] Legal Provisions for a National Statistics System. Chapter 5 of United Nations Handbook of Statistical Organization. Studies in Methods, Series F, No. 6, 1954, New York. (This checklist has been incorporated in Appendix V.)

9.5 Provision for a central health statistical authority

As far as possible the law should provide for the establishment of a health statistics organization within the health agency. This provision is important because in the absence of legal provision the development of statistical work suffers on account of other urgent demands made on the health budget from time to time. This legal provision should also define the operating, promotional and co-ordinating functions of the health statistical office, the duties of which should be in general terms to:

1. advise on matters of health statistics policy in various forms of health activity;
2. collect, compile, analyse and publish statistical information relative to the health statistical fields and health conditions of the people;
3. collaborate with all other departments of the government in the collection, compilation and publication of statistical records of administration according to the regulations;
4. organize general health surveys or ad hoc statistical investigations.

9.6 Provision for a central co-ordinating authority

Where it is considered desirable not to entrust the administration of health statistics work to a central agency, but to decentralize the work either because of the large size of the area covered or large amount of data, legal provision must fix the responsibility and give the co-ordinating agency the authority to carry out its work. In a relatively decentralized system there must be clear and specific legal provision to support the co-ordinating agency, to strengthen the force of its actions and to secure a greater likelihood of compliance. The status of an agency is considerably enhanced if it is made responsible for allocating funds or reviewing the budgets of the statistical units. The establishment of a co-ordinating agency in the form of National Committees on Vital and Health Statistics has already been recommended by the World Health Organization.

The co-ordinating body should also be empowered to review (1) staff requirements, (2) forms and questionnaires, and (3) publication programmes. In some countries the legislation provides for a common statistical personnel throughout the service; in other countries for the establishment of boards and committees charged with the control of printing forms and reports.

9.7 Criticism by the public of the draft legislation

Any statistical law to be established will need the collaboration of the people concerned. It is always advisable to present the draft legislation for criticism by interested individuals, institutions, and the public, and take it into consideration before the draft becomes law. A health worker may be so interested in the work of maternal and child health as to urge that every pregnancy be reported to the health department in its second or third month, but public opinion would not sanction such a law. Other ways and means have to be devised such as an instruction to the public health nurse to visit the homes and make confidential enquiries.

9.8 Law enforcement compared with education and instruction

Even within countries which have organized statistical systems it has been found difficult to deal with offences against the law, particularly in connexion with the *refusal to answer* and the *neglect or delay* in providing information. Instances are on record when voluntary reporting of births and deaths happened to produce better results than compulsory legislation. If the legal penalty for non-reporting is small or if the law is not enforced, people are apt to let things take care of themselves. Some countries which can afford it have tried rewards instead of penalties, or both rewards and penalties as in disease notification. In some countries the indigenous midwives are paid a fee for reporting each delivery attended by them.

Every effort should be made to get the people to feel that the health statistical organization of a country is worthy of trust, and that it has the duty of carrying out its share in promoting the general welfare of the community.

There should be a constant campaign to educate those who answer the questions. The use of persuasion to gain the co-operation and understanding of the public is a policy which has borne fruit in most countries. "We do not so often as before attempt to use legislation as an educational force, but depend on education to create public opinion to demand legal support for health protection." (Haven Emerson)

9.9 Confidential nature of information and provision of penalties

Legal protection of the confidential nature of information furnished is an inseparable counterpart of the legal obligation to furnish it. In some countries disclosure is permitted with the previous consent in writing of the person concerned. The clauses restricting the use of information furnished in confidence should be rigidly applied in every case if the confidence of the public, a medical officer, or institutions is to be maintained. This is particularly so when the law in any country provides for the notification of venereal disease, leprosy or tuberculosis, which may carry social stigma. Unless full confidentiality is observed, reports cannot be complete. The same is true of the registration of illegitimate births. The penalty clauses designed to bring compulsion upon those respondents who refuse to supply information, or who give false answers should, at the same time, also provide for the imposition of penalties upon the personnel of the statistical offices who improperly divulge information or permit its unauthorized use.

These conditions apply also to the publication of statistical data in enough detail to disclose particulars relating to individuals.

The statistical law should require that every person employed in the execution of any duty thereunder, before entering upon his duties, should take and subscribe to an oath of office. This oath should contain the solemn undertaking that the person will not, without proper permission, disclose or make known any matter which comes to his knowledge by reason of employment as an officer or employee of the statistical office.

The problem of securing confidentiality of health statistics has been well described by M. J. Aubenque and M. G. Neurdenburg who have also de-

scribed legal and other provisions for this purpose,[1] (see also Section 13.2.6).

9.10 Texts of national legislation

The International Digest of Health Legislation published quarterly by WHO contains a selection of health laws and regulations (including some on health statistics), a bibliographic section and, from time to time, studies in comparative health legislation. Texts of statutes are, according to their general interest, reproduced in full or in extract form, summarized, or mentioned by their title.

[1] Problems of confidentiality in reporting morbidity and causes of death by M. G. Neurdenburg.

Le secret des informations et les statistiques sanitaires by M. J. Aubenque .Both articles appear in Bulletin, World Health Organization, 1954, 11, 51-66.

CHAPTER 10

Designing Record Card Systems

10.1 Introduction

For the routine collection of health statistical information record cards should be designed in respect of individuals, households or institutions. Consideration has also to be given to the means by which the information can be used by health workers, (i.e. for the interchange of information between different agencies and persons in and out of the health department). In addition, there will be other occasions when the health statistician is called upon to design recording systems, such as special studies on communicable diseases, chronic diseases, maternal and child health work, or school health work. No health department, big or small, works without some kind of a recording system, but the records are efficient to varying degrees. The importance of good records in maintaining the efficiency of health administration is being increasingly recognized. Experience has shown that the quality of data collected depends very much upon how the record card was designed and the system established for its use. Efficiency in card design can save a lot of unnecessary writing, and greatly ease subsequent processing of the data. Not infrequently, where the final report is badly completed, the fault lies with the card design.

The designing of the card demands from the statistician the highest professional skill, together with first-hand knowledge of the material. Cards cannot be prepared in a hurry. Time is needed to study local conditions and it is only after repeated trials that an acceptable recording system can be worked out. Although the advice of various members of the health staff is invaluable and should be sought, the task of designing the card must rest with the statistician. An excellent guide for this work has been prepared by Olive G. Johnson.[1]

10.2 Tendency for overgrowth of records

In health departments which have been in existence for some time, records, questionnaires, forms, returns, schedules, etc. are an evergrowing menace. It has been said, with good reason, that in a health department the one disease we must definitely declare quarantinable is the disease generated by questionnaires. The parallel with disease is relevant because epidemic outbreaks of records occur and invariably the endemic level is high. The etiology is known

[1] Records and Reports of Local Health Departments—Criteria and Methods for Organization, Maintenance and Use, by Olive G. Johnson. Monograph No. 15, US Public Health Service, 1953.

and it is a statistician's task to undertake control measures. In one small sized country the Director of Health Services was getting as many as 1000 different kinds of forms, returns, questionnaires, etc. printed each year by the Government Press. One county of the United States with 3000 population had, over the years, accumulated over half a million records of which 175,000 were primary records and the rest duplicates. The time taken to complete information with the sometimes meagre staff of the health department and the workload on the staff, hardly justifies the running of the service. In spite of the cost involved in completing and maintaining the records, sometimes little work is done to organize an efficient procedure of record keeping to get the maximum amount of information with the minimum of effort. In certain areas where deterioration of health services has been observed, this could often be attributed, at least in part, to an excessive load of unproductive clerical work. How can such statistical chaos be avoided? How can the recording system in a health department's activities be kept in economic and efficient operation?

10.3 Guiding principles or criteria

No health agency can adopt a system developed elsewhere without a thorough examination of its suitability. The first step is to consider some guiding principles governing new recording procedures, or to test those already in use. It is with this in view that the following principles are suggested. The greater the attention paid to them, the better will be the quality of the information collected.

1. Records should be designed to meet specific needs of administration, technical activities, research projects, periodical or final evaluation. The underlying principle is that the aim of health work should be to promote health and not merely good reports. Therefore, a clear definition of the general and specific objectives of the programme and of the methods to be adopted for their accomplishment should first be formulated.

2. The time and expense involved in maintaining the record system should be justified by its present and potential uses. The items to be included should therefore be carefully chosen. The fundamental question to ask is whether the information will be used, by whom and how often. The period for which the data should be recorded and preserved should be estimated.

3. A properly maintained record system should aid in the effective administration of the health services and at the same time provide data for legal or scientific needs. The statistical information to be derived from them is only one of the many purposes which such records are intended to serve.

4. Each record system should be considered as an integral part of the entire system of the health department. This is specially important in connexion with the registration of vital events.

5. There should be no unnecessary duplication in the collection of information. Paper work should be reduced by eliminating non-essential details as well as diversity of forms in use. The number of record forms

seldom remains stationary, unless special efforts are made to keep them at the essential minimum. The maxim "it is easier to add than to subtract" is especially true of forms. An important principle in this connexion is "one case, one report".

On the other hand, records should lend their support to improving the quality of data collected by the various units of the health agency, and filling gaps in the information.

6. The paramount consideration is simplicity. The record system should be within the means and the capacity of the health staff who may already have a heavy workload, may not be statistically minded, and may have to fill information without adequate supervision. However desirable the information may be for statistical purposes, it is useless to ask for it unless it can be provided by the staff with reasonable speed, facility, accuracy and completeness. The time of doctors or the senior health staff is scarcer and more expensive than that of statistical clerks. Highly trained persons should not be expected to do anything that can be done by cheaper labour or by machinery.

7. For the most part, the information on records should be a byproduct of the administrative operation of each health programme.

8. The record design should emerge as a co-operative effort of all concerned in the possible use of the data recorded.

9. A priority should be established for the inclusion of items on the record, noting the items which *must* appear on each record, and fixing an order of priority for others. The temptation to include items on the off-chance that they may be useful some time should be resisted.

10. The system should conform to requirements of standard classifications, terminology and definitions (fiscal, legal, technical, etc.) set by the local authority, country, and international agencies.

11. The design of the record card should facilitate the recording of essential data without error, without possibility of misinterpretation, and in the minimum of time. This is achieved generally by stating against individual items on the printed card the several mutually exclusive categories into which the information can fall. Blank spaces are provided against each category so that recording is reduced merely to checking the blank space.

12. A record card should be tested in the field in the most difficult conditions before being admitted to the routine of the service.

13. Every form should bear an adequate title indicating the name of the health agency, place, code number to identify the form, and a footnote should show the quantity printed, date of printing, and the date of revision.

14. A record card should be of good quality firm paper and should if possible be printed. Coloured corners or bands facilitate handling, and have a good psychological effect.

15. The mechanics of record keeping should incorporate modern developments in equipment, supplies, printing, recording, quality of material used and reference aids. The wording and position of the entries, method of completion (by hand or typewriter), size of type, need for ruled lines, need

for carbon copies, etc. should be considered. If possible, the size of all record cards used in a single health agency should be uniform.

16. The record system should invariably be accompanied by a detailed Manual of Instruction for its use. The terms used on the record cards should be clearly defined in the Manual so as to allow uniformity of comparison in respect of both time and place. While written instructions cannot take the place of verbal explanation and guidance, they are essential for reference, and help to maintain a consistent standard of reporting.

17. The form in which information is recorded on cards should be such as to simplify its subsequent statistical analysis, i.e. the records should be amenable to later sorting and tabulation whether by hand or machine. Thus, if an item of information is to be used for statistical purposes, its entire route from the moment the entry is made, to the desk of the official responsible for planning, must be thought out from the start. This implies laying out the framework of at least the most important tables eventually to be prepared.

In designing a record card a question to be settled is whether to use an individual or a household card. If subsequent processing of data is to be done by hand, an individual card is usually more convenient. When mechanical processing is contemplated a household card may sometimes be found more efficient and economical.

Registers and lists are inconvenient if not useless for statistical purposes. The keeping of bound registers is time consuming, so any in use should be examined to see if they are necessary for legal and administrative purposes. Even if this proves to be the case, the number of particulars to be recorded can probably be reduced. On the other hand, the punch card file maintained at the central office can serve a number of administrative purposes as well as provide statistical tables.

10.4 Types of information recorded on cards

Information is recorded for subsequent statistical purposes either as a written factual statement or in figures.

10.4.1 *Factual information*

As a general rule, a well designed form should contain as few places as possible in which a written statement has to be entered. Of course the cause of death is required to be entered in full in accordance with the international form of medical certification. This is done because, although a detailed code for international use has already been prepared, it cannot always be consulted at the time information is being entered. In other cases the convenient procedure is to print all the alternative statements on the form of which one is to be selected by check mark. The categories should be mutually exclusive and exhaustive. Provision should be made for entering "unknown", "none" or "other".

10.4.2 *Numerical information* is relatively easy to enter if proper blocks or spaces are marked and clearly defined. In some cases, like age recording, it

is more convenient to ask that the date of birth be entered. The age can then be calculated. Similarly, for recording the length of gestation added accuracy will result if the date of the beginning of the last menstruation is asked for.

10.5 Handling of records

No adequate method of general application can be suggested for handling records which would meet the needs of all health departments or hospitals or health centres. Usually they are kept separately in the different services; that is, for tuberculosis, venereal diseases, maternal and child health, etc., with little or no co-ordination. This leads not only to duplication of effort, but may interfere seriously with the provision of services to the patient. If, as is often said, a patient or healthy individual should be considered as a *whole* being, it is obviously necessary to provide a record system which would assist the health worker in accomplishing this task. He should therefore be provided with as complete a picture as possible. For instance, in hospital work this is accomplished by the use of the *unit* system, where all the records on the same individual are kept together under a single code number. A corresponding scheme in a local health department would involve a centralized record system. This means that all the records would funnel through one central place. The most important consideration in establishing and maintaining a centralized record system is to open up channels for communication and interchange of information between the various divisions, and personnel of the health department. The emphasis is not merely on the *form* of the records, but on the *system* for keeping them.

A centralized system may present many complications. For example, if the area covered is wide and the health department facilities are not located in the same building, difficulty of communication may arise. Often more than one person or clinic will need a record of an individual at the same time. In addition, in some countries certain records such as reports of venereal disease and tuberculosis are reported by number and not by name. For these reasons no single system is likely to serve all situations.

According to the needs which arise in collecting varied types of information several different units of count are employed as, for instance,

1. *Activity*: the item of service given — visit, X-ray, immunization, premises inspected.
2. *Case*: a condition of an individual needing care.
3. *Individual*: the person under care.
4. *Household*: one or more than one member may receive benefit from service.
5. *Premises*: the plant, establishment, location or area to which sanitation activity is related.

10.6 Case registers

For chronic diseases we need a system by which pertinent information regarding each case is separately maintained to show medical examinations, diagnostic findings, treatment, and socio-economic data. Such a record

permits the health department to have all cases of a specific disease in one place to facilitate case holding, case management, evaluation of activities, or the definition of local problems. Manuals for the maintenance of such registers on cancer, tuberculosis and rheumatic fever programmes have been published.[1]

Systems of records and record keeping need special care in preparation when a large group of people is followed up over a relatively long period of time. Opportunity for follow-up often occurs in medical work. For example, cases of tuberculosis have to be observed over a long period by the health department; so too with cancer treatment to determine survival rates. The *case register* used for this purpose is a system of records for maintaining a current summary of pertinent medical and health data on patients who, according to health department policy, require some type of supervision. Its main object is to maintain current records on individual cases. This is done because the point of view which characterizes the activities of a health department is different from general medical recording. In private medical practice, as well as clinic and hospital work there is no assurance that the information on the current status of the patient can be obtained. The reason is that the initiative in returning for medical care rests with the individual patient. However, because the health department is concerned primarily with the health of the community, it may, and often does, take the initiative to ensure that certain information about patients who may be a danger to others is kept up to date. The case register is the machinery by which the health department keeps itself informed about the cases which affect the entire community.

The requirements for a case register are: a central location for keeping the records of a certain group of patients, and a system which provides for obtaining systematic, current information about these patients. The latter is by far the more important part of the case register and unless a system is devised for issuing "reminders" and inquiring about missing data, it quickly degenerates into a simple file.

The form designed for the face of the card generally contains three essential points. One is for recording the identifying data, namely, that part which is not likely to change. The second part is devoted to the periodic reports and therefore consists of information about changes that occur in the status of the patient as regards his disease and its supervision. The third part is a kind of signalling system to assist the registrar in getting the material when he wants it. The back of the card usually contains general comments about the family, home nursing visits, and about other members of the family who are contacts of the case, and the services they receive.

[1] *Cancer:* Maryland State Department of Health, Manual on Cancer Register.
Tuberculosis: State Central Case Record System and Local Case Registers for Tuberculosis, by the Tuberculosis Control Division, US Public Health Service, North Carolina State Department of Health, 1947.
Rheumatic fever: The Registry in the Community Rheumatic Fever Programs. American Journal of Public Health, Vol. 38, 1948, pp. 1088-1091.

10.7 Mechanics of record keeping

Several systems have been devised for maintaining records (Weeks 1946, Leffingwell and Robinson 1950).[1] The main considerations in selecting the equipment, reference aids, supplies, etc. are prompt identification of the record, convenience in use, security against loss or misfiling, and economy in the use of clerical assistance and space.

Single card records may be filed in vertical card files with guide cards to facilitate search. Expansion of the file is easy by adding more cards but there is the chance of misfiling. In the visible card file, which is more expensive, a part of the card becomes visible as the tray or drawer is opened. For the maintenance of family or household data folders are used to bring together all the cards of each family or household. Coloured pages or coloured borders simplify their use. In using coloured cards it should be remembered that some colours provide a poor background for photographs — and should be avoided.

Failure to use existing records can frequently be traced to the difficulty of consulting them. This may arise from distance from records or a bad filing system. The record filing system should distinguish between the "active" records and the "inactive" ones.

In a centralized system all medical, nursing, and sanitation records are in one office. This achieves uniformity, eliminates duplication, and ensures efficient use of space, equipment and clerical staff. But then the records may not be conveniently accessible to all units. In this case an efficient system for delivering records by messenger or mechanical means is essential. In a decentralized system, even though each unit will have easier access to the records of its own service, the data may tend to be restricted and lead to lack of uniformity of definitions, standards and supervision, and increased operational costs. Central control of a decentralized system would help to remove some of these disadvantages.

The arrangement of filing records is important. It may be numerical, geographical, alphabetical, chronological, or by service or activity category. The numerical method of filing records requires a numbering system and an index for cross-reference.

To assist in the use of records several devices are employed such as cross-reference indexes (e.g. the family and individual indexes of names and unit numbers). A special card (called an out card) should replace records when they are temporarily removed from the file, to show who has borrowed them and whose records were borrowed. These cards usually stick out about half an inch above the rest of the drawer to make the refiling easier.

10.8 Record committee

Those who have to plan a recording procedure may find the task relatively

[1] How to file and index, by B. M. Weeks. New York, N.Y., Ronald Press Company, 1946.

Textbook of office management, by W. H. Leffingwell and E. M. Robinson. New York, N.Y., McGraw-Hill Book Company, 1950.

easy for any specific activity relating to any single locality or situation. It is not so easy for an integrated health programme covering several activities dovetailing into one another. It is simple for any one survey on an *ad hoc* subject, but multipurpose surveys with multipurpose activities present difficulty. Further, it becomes extremely complex if we have to create a uniform procedure for health programmes at various levels throughout a country. To satisfy the individual requirements of each health authority, and at the same time ensure uniformity in standards and integration, the best procedure is to set up a Committee for records and reports consisting of representatives of various sections, to meet periodically and review the material. The statistician acts as the secretary of this Committee, as he has to come into the picture at several stages of the recording and reporting system and assists the Committee on standard terminology, definitions, classifications ant the preparation of the manual of instructions.

A centralized responsibility for organization and administration of reports has the advantage of securing uniformity of content, design, comparability of data, consistency of procedures and accessibility of information to all units. This can be secured by the Committee even if the records are physically located at different places. The designing of the record card should remain the principal responsibility of the statistician, but group thinking helps to produce a comprehensive and improved system. A revision frequently reveals instances where information was collected to meet an anticipated need that never materialized or that has long since vanished.

The Committee should also look into the problem of training the staff in the preparation and maintenance of records. In particular, it should advise on the following points: size, shape and quality of the record cards in use; design and printing; filing procedures (periodicity) for both active and inactive cards; arrangement (alphabetical, numerical, district); location of records, and their use in treatment, programme planning, supervision, etc.; frequency of use; items of data recorded; coding procedures; completeness and accuracy of information recorded, and the Manual of Instructions. The reasons for any failure to use the records should be investigated.

In many health departments records are maintained for persons served by programmes for the control of acute communicable diseases, as well as for sanitation measures adopted. As new services are added as, for instance, for cancer and other chronic illnesses, medical care of the indigent, rehabilitation programme, more and more records may be introduced haphazardly, unless of course some simple, effective and adaptable procedures are undertaken and kept under review.

An example of the success that can be achieved by appointing a committee on records and forms has been reported by Charles Wilbar of the Pennsylvania Department of Health, U.S.A. For three years this committee met regularly at monthly intervals. The Deputy Health Officer was the chairman; other members were the Director of the Bureau of Statistics and Records, the heads of the tuberculosis, sanitary engineering, biological and supplies departments, and the Regional Public Health Nurse. After the first year a

procedure analyst joined the committee and became the key person in its activities. The committee soon won the confidence of the various directors who came to appreciate its work in their own interest. It instituted a "Request for Form Approval" which had to be sent with all orders for forms including paper specifications, uniform department headings, volume of storage, and a numbering system. It kept the departmental staff fully informed not only of its actions but also the reasons for them.

As the result of the committee's work there was a marked reduction in the number of forms. In one bureau alone the number decreased from 396 to 186. Considerable reduction in numbers was achieved both by reducing the size of the form and by ordering in quantities that permitted saving without overstocking. Standardization and integration of forms was accomplished, and forms used for similar purposes were put on similar designs. Previously the forms used in different clinics had similar items scattered in different places. More uniformity of arrangement was introduced, making the task of the public health nurse working in the various clinics much easier. C. Wilbar says that "probably the most significant accomplishment of the committee has been its demonstration to the administrators in the department of the value of good records and of the relationship of records and forms to the philosophy and formulation of programme direction. It has become apparent to most administrators that poorly designed forms can waste more time and money. The move towards uniformity of forms has made administrators more aware of the problems faced by other units of the department and the way the various programmes mesh into the whole programme of the Department."

10.9 Specific purposes of programmes

It was stated earlier that each individual recording programme should be directed at serving specific purposes and needs. These may be one or more of the following:

1. To keep note of findings or observations of clinical and laboratory tests, services given and recommendations made to individuals and members of their households, in routine examinations or visits.
2. To ensure that items can be related without having to search through scattered sources.
3. To provide source data for epidemiological or statistical studies on morbidity and mortality among women, children, and possibly in the general population.
4. To evaluate the results of health activities in relation to treatment, diagnosis and disease incidence, and especially in relation to the needs of the community.
5. To help other work of the local health department, such as case finding and case holding.
6. To provide guidance in the improvement or extension of health and medical programmes by determining the problems arising in them, and in directing programmes towards future needs.

7. To assist in carrying out special sampling surveys in public health and other fields.

8. To provide historical data over a number of years to compare with the past and with the experience of other projects.

9. To provide ready information on resources or activities of the staff, i.e. a measure of the services given by health centres.

10. To analyse services in relation to administrative procedure and costs, and hence to provide a basis for future planning and budgeting.

11. To provide material for future investigations.

12. To provide material for public information, health education, press, radio, exhibitions, and speeches.

13. To provide material for periodic reports on individual programmes, or of the entire health department.

Where documents are centralized for statistical processing, the statistician has to ensure that workers at the periphery are made aware of the use to which the data they gather are put. Peripheral workers should be made to feel that statistics can be a help to them in learning more about their own area, in doing a better and more interesting job, and in appreciating the results of their work. This helps in maintaining goodwill, and in doing so the statistician gains insight into the nature of his problem.

CHAPTER 11

Sampling in Public Health

11.1 What is sampling?

Sampling is a procedure by which some members of a population — people or things — are selected as representative of the entire population. The object of this selection is to make some further observations or measurements on each of the individual members so selected and on the basis of these observations to draw conclusions regarding the whole population. The sub-group thus selected to represent the population is known as a *sample*.

The conclusions that we draw from a study of the sample are of course subject to one special kind of error known as the sampling error (in addition to other errors which may creep in even when the coverage is complete). But we can plan the procedure of selecting the individuals in the sample in such a way that this error would be within certain previously specified limits. Thus we can choose the size of our sample so that this error will not exceed (say) $\pm$ 10% of the value with a prescribed degree of assurance.

11.2 Use of sampling in public health

A few examples of the use of sampling in public health are given below:

1. To obtain information on the health conditions of a population for the purpose of planning new health programmes.
2. To test the efficacy of a new health measure on a sample before it is tried on the whole population.
3. To evaluate the degree of completeness of birth and death registration or disease notification.
4. To prepare preliminary reports of vital and health statistics in advance of the final reports which take longer time for preparation.[1]

11.3 Advantages of sampling

Briefly stated, the main advantage of sampling is that it enables us to know about a large population with reasonably low cost and at greater speed, compared with a complete enumeration of the population. Modern sampling theory has been developed to obtain unbiased information about the population with the maximum accuracy and precision for the labour and money expended. Even more so, it provides us with a measure of the amount

[1] See: On the uses of sampling in the field of public health, by the Special Sub-Committee on Sampling Techniques in Public Health Statistics of the American Public Health Association. American Journal of Public Health, Vol. 44, No. 6, pp. 719-740,1954.

The use of sampling for vital registration and vital statistics, by P. M. Hauser. Bulletin, World Health Organization, 1954, 11, 5-24.

of error introduced into our results by the sampling process. It is of course true that any estimate made from a sample is subject to error; what is equally true is that usually any estimate made from a survey of the entire population is also subject to error from many other sources such as from non-response, in measurement, in the preparation of estimates, and errors due to the fact that the population characteristics change with time.

In surveys covering large populations or areas it is generally inexpedient to examine all individuals because of the prohibitive cost involved, lack of trained staff and the long waiting period before the entire data can be processed and evaluated. Sample surveys are especially advantageous when information is not required on each of the small sections or communities into which the population can be divided. With a few reliable trained investigators working on a properly selected sample of the population we can obtain more accurate information for the entire population or for each of a few subdivisions of the population, than would be possible by a larger team of less trained workers investigating on all individuals of the population. For this reason in almost all branches of statistical studies on human populations sampling procedures are gradually replacing complete surveys. Researches in the recent past have led to rapid advances in sampling techniques and standardization of methods and terminology, contributing to a high degree of accuracy in a sample survey at minimum cost. Great interest in this matter has been shown by the United Nations through its Sub-Commision on Statistical Sampling (see Section 11.9).

In a sample survey it is imperative to select the sample properly so that the characteristics of the population can be accurately estimated. Constant care at all stages of the sample survey is needed, and the points at which any projected survey will be most vulnerable should be foreseen. Experience has shown that with the available resources concentrated on a relatively smaller sample the increase in the sampling error owing to smallness of sample size may be more than compensated for by the reduction of other sources of error, such as those arising from non-response or errors in measurement.

11.4 Criteria for a good sample

A good sample must satisfy certain criteria:

1. Following the familiar economic maxim that one should get the most for one's money, we should try to select that sample which will yield the highest degree of accuracy for the funds available. In other words, if the degree of precision to be attained in the survey is specified, the design should provide it as cheaply as possible. In this connexion the first point to be decided upon in planning a sample survey is: how precise would we like the estimate to be? This question is usually answered by specifying the sampling error which we wish our estimate to have. While a smaller sampling error is of course preferable to a larger one, a demand for higher precision involves greater cost. Account should be taken also of the magnitude of errors arising from other sources. For instance, if we wish to estimate the prevalence rate of a certain disease in a population correctly to within a sampling error

of ± 10%, we should be sure that other errors likely to arise in this estimate, such as the personal error of the investigator, are not likely to exceed 10%. There is no point in having a very small sampling error if other errors still make the estimate imprecise.

2. The sample should be designed in such a way as will make it possible at a later stage to compute the sampling error. This is possible only when the sample is designed according to certain statistical procedures. When such procedures are followed, the sampling error can be estimated by means of a formula.

3. The sample design should be practicable. Some of the designs may require the sample to be spread over the whole area under study, which may be administratively difficult to manage. Others may involve a complex tabulating procedure after the data are collected. Therefore the sample theory and practice must be compatible.

11.5 Methods of sampling

11.5.1 *Random sampling*

One common method of drawing a sample is what is appropriately called "simple random sampling". This method gives every unit in the population an equal chance of being included in the sample. First, the population is subdivided into "sampling units". Thus, for instance, when a survey is to be carried out on a household basis, each household is regarded as a sampling unit. All the sampling units are then serially numbered and the percentage of them to be included in the sample, i.e. the sampling fraction, is decided upon. One method which can be adopted for drawing the sample is to prepare a separate card bearing each serial number of the household — as many cards as the total number of households. The pack of cards is then thoroughly shuffled and as many cards are pulled at random out of the pack as the number of units we require to include in the sample. The cards, thoroughly mixed, have each an equal chance of being included in this sample, and since each card corresponds to a sampling unit in the population, the serial numbers thus selected constitute a random sample of the population under study. The need to prepare separate cards can be obviated by using published tables of random numbers. With their help the drawing of a random sample is reduced merely to reading the several numbers of the households which fall in the sample. If a random sample of individual persons is required, the procedure is the same except that a serial list should be prepared of all the persons.

The drawing of a random sample is thus based on a list of the sampling units in the population. But such lists as are often found may be incomplete or involve duplication or contain inaccurate information, despite the most authoritative assurances to the contrary. A revision of the list and its completion would, therefore, be necessary in most cases. In the absence of such a list, one should be compiled, even if it is found to be expensive and time-consuming. Lists of households, families, and individuals would be needed in the health survey. All the three lists could, of course, be prepared simul-

taneously, and this may be done at the time of the population census.

11.5.2 *Other methods of sampling*

The principle of simple random sampling is the basis of all good sampling techniques. For different frameworks of the survey, however, certain variations or improvements can be introduced. The aim of these modifications is to increase the accuracy for a given cost. Such modifications are introduced by means of stratification, sampling by stages (multistage sampling), systematic sampling, or what is called the multiphase sampling. A brief account of these techniques is given below. For a fuller and more detailed discussion of sampling methods, the reader is referred to Frank Yates[1] or William G. Cochran[2].

11.5.2.1 *Stratified sampling*

The stratified sampling differs from the simple random sampling in that the population is first classified into suitable subpopulations or strata and a separate sample is then drawn at random from each stratum. By this procedure each of the subgroups of the population will be more accurately represented in the total sample and the sampling error will be reduced. The need for stratification also arises because statistics are required separately for each stratum in that different strata may present quite different field problems which are best handled independently.

For the purpose of improving the sampling precision strata are formed in such a manner that each stratum is homogeneous internally and the different strata differ as much from each other as possible. For instance if we are interested in estimating tuberculosis morbidity, we may first divide the population into several strata according to such factors as age-group, sex, socio-economic status, or by geographical regions. A sample is then taken independently from each stratum by selecting the same proportion of units from each stratum. However, when the degree of homogeneity within each stratum or the cost of surveying per unit varies considerably from one stratum to another, it would be more profitable to increase the sampling proportion within a stratum where the units are highly variable or cheap to survey.

11.5.2.2 *Multistage sampling*

Multistage sampling becomes necessary in large-scale surveys covering the population of the whole province or country for which the preparation of complete lists of the final sampling units such as for households or individuals may seem impossible. Multistage sampling is also used when the number of localities to be actually surveyed is limited on account of administrative difficulties.

In this case, at the first stage a list of large-sized sampling units is prepared,

[1] Sampling Methods for Censuses and Surveys, by Frank Yates. Charles Griffin & Co. Ltd., 1953, London.

[2] Sampling Techniques, by William G. Cochran. John Wiley & Sons, 1953, New York.

such as of groups of villages lying in compact blocks comprising several thousands of persons. A certain number of such large-sized units is selected at random. At the second stage, for each of the chosen large-sized units a list is prepared of the sampling units on the basis of which subsamples are drawn by random sampling. The sampling is thus carried out in two stages. The process can obviously be extended to three or more stages.

The advantage of multistage sampling is that it gives more flexibility in the planning. The sampling error is usually higher than in surveys having the same number of units on the basis of simple random or stratified random sampling.

11.5.2.3 *Multiphase sampling*

In a multiphase sample certain items of information are collected from all the units of the sample while other items are collected from only some of the units, i.e. a subsample. For instance, clinical examination may be done on all persons included in the sample but laboratory tests may be carried out on only a randomly selected one-half or one-third of the clinically examined persons. Multiphase sampling is thus used to obtain supplementary information in the second phase. It is useful when the collection of information on *some* items of a detailed nature requires much cost and labour and cannot be carried out for the entire sample.

11.5.2.4 *Interpenetrating samples*

When a number of workers are engaged in a survey it is sometimes found advantageous to draw two or more independent samples so that each sample is investigated by a different survey team to supply its own independent estimate. We thus obtain what are called interpenetrating samples. It is possible to keep some of the sample units identical in two or more interpenetrating networks, so that information is independently collected twice or oftener. It is then possible to make detailed comparisons between two or more sets of observations. Interpenetrating samples are found useful in securing information on non-sampling errors such as differences arising from personal bias of the investigator, varying methods of eliciting the information, etc. The interpenetrating network provides a means of control or appraisal of the quality of the information collected.

11.5.2.5 *Systematic sampling*

Frequently, instead of drawing a random sample from serially numbered units we may carry out "systematic sampling". For this purpose, if we are to select in our sample let us say one-fifth of the population units, we first draw a random number lying between one and five, to mark the first unit chosen in the sample. Suppose that we first selected a random number, say 2. The sample consists of the units with the serial number 2, 7, 12, 17, 22, 27, 32, etc. This sample, called the systematic sample, is easier to select than a simple random sample, particularly if the drawing is to be done by the field staff. It is likely to be more accurate than a simple random sample if there

is a trend in the measurement which follows the order of numbering. All the same, the use of this technique may be risky. For instance, in sampling households if it happens that every fifth house is situated at the corner of a street, the sample selected by the above technique may either contain corner houses only or exclude them altogether. In general practice, the sampling error of a systematic sample is approximately estimated by applying the formula for the random sampling.

11.6 The question of non-response

In surveying human populations, the difficulty invariably arises of contacting, examining or interviewing people. Some may be away from home, others unwilling to co-operate — and this occurs especially when the investigation causes some inconvenience to the person (such as drawing blood for the detection of infection). Any sizeable percentage of non-response would make the results obviously open to question. Sometimes non-response is allowed for by substituting other individuals for those who were hard to find or non-co-operative. But substitutes rarely solve the problem. They merely increase the size of the sample in that section of the population which is amenable to our survey. One method of meeting the situation is to concentrate on a random subsample chosen out of the non-responding cases and to make every possible effort to obtain the data from individuals falling in this subsample so that at least some information may be secured about this group.

11.7 Pilot survey

A pilot survey is carried out to obtain information which will facilitate the planning and execution of the main survey. The main purposes of a pilot survey are:

1. to examine survey techniques to be used — such as adequacy of various definitions, design of the questionnaire, and interviewing method;
2. to obtain necessary data on the variability existing in sampling units in order to provide some rough basis for stratification and estimation of the sampling error;
3. to obtain data on the amount of labour and money required to carry out the main survey;
4. to give the staff an opportunity to get accustomed to the various other problems met with in executing the main survey.

The pilot survey should preferably provide information in such a manner that it could be incorporated into the information provided later by the main survey.

11.8 Bias

If, because of either the subjective or personal error of the investigator, or the faulty technique of measurement, there is a consistent over-estimation or under-estimation of the average value, the sample estimate is said to be biased. Bias can also be introduced through forgetfulness on the part of the

informants or the refusal of individuals to supply accurate information, or through the use of unreliable diagnostic techniques. Bias of this kind cannot be reduced or eliminated by increasing the number of observations, but only by the adoption of sound sampling and better survey techniques.

11.9 Recommendations of the United Nations Sub-Commission on Statistical Sampling

The United Nations Sub-Commission on Statistical Sampling has set out certain recommendations for the preparation of reports on sampling surveys in order to standardize terminology, ensuring clarity, comprehensiveness and international comparability in the reports dealing with the aims, methods used and accuracy obtained in sampling surveys.[1]

Here is a summary of the principal recommendations:

1. In a general description of the survey, mention its scope and purposes, nature of the information collected, sampling method employed, accuracy, cost, personnel, equipment. Give an assessment of the extent to which the purposes of the survey were fulfilled.

2. In the description of the survey design specify the domain of the study, the frame used for selecting the sample,[2] distinction being made between elementary observation units and sample units; give full information on schemes of stratification, stages and phases of sampling, what fraction the sample was of the population and the methods used for selecting sample units and means of controlling or appraising the quality of the data collected. The description of the design should conform as far as possible to current established terminology.

3. Describe the statistical methods followed in the compilation of the final summary tables and the computational procedure used.

4. Information concerning the accuracy of the survey as indicated by the random sampling errors deducible from the survey, non-sampling errors, accuracy and adequacy of the frame, and comparison with other sources of information, should be included.

11.10 Sampling methods used in recent morbidity surveys

Sampling methods have been used in connexion with morbidity or health surveys in several countries. In England, owing to food rationing or hardships during the last war, it became imperative that the health of the nation be closely watched. Beginning in 1943, some 4000 adults were interviewed each month throughout England and Wales to record their medical history during the preceding two months (later one month only) and social background. In two-stage sampling, the first-stage units were administrative districts of four types: cities, towns, urban and rural districts. At the second stage individuals were sampled from card indexes or the National Register of

[1] See: United Nations "The preparation of sampling survey reports". Statistical Papers. Series C No. 1 (revised) February 1950, New York.

[2] The frame consists of previously available descriptions of the material in the form of maps, lists, directories, etc. from which sample units may be constructed and a set of units selected.

adults. The method of selecting the national sample has been described by Gray and Corlett.[1] The survey was continued till April 1952. A report on the observations, including the sampling techniques and definitions of the terms used, has been published by Logan and Brooke.[2]

Canada carried out a nationwide sickness survey for 12 months during 1950-51 on the basis of a sample covering about 40,000 persons. Its purpose was to estimate the incidence and prevalence of illness and accidents, the amount of medical, nursing and other health care received and the amount spent on the family for various types of health services. Each household included in the sample was provided with a calendar on which all the illnesses occurring among members were recorded on a day-to-day basis. The results appear in a series of special compilations. The use of sampling techniques designed for this purpose has been described by Dale[3] and Harris.[4] The methodology of undertaking surveys in India has deen developed at the Indian Statistical Institute, Calcutta, by Poti *et al.*[5]

In the Danish National Morbidity Survey sampling was done in two stages. All rural communes were first grouped into a number of first stage sampling units of about 2000 adults. These in turn were grouped into a number of strata each comprising about 60,000 adults. Towns and metropolitan suburbs were grouped into separate strata. From each of these strata random selection was then made of about four first-stage units. Within the selected first-stage units a random selection was made of the required number of the adult population, (see Hamtoft[6]).

The most recent example of the use of sampling methods is provided by the US National Health Survey, which began in July 1957[7]. The sampling plan follows a multistage design permitting a continuous sampling of the population. The first stage consists of sampling 372 units from about 1900 geographically defined primary units, into which the country has been

[1] Sampling for the Social Survey, by P. G. Gray and T. Corlett. Journal of the Royal Statistical Society, Series A (General), Vol. CXIII, Part II, London, 1950, p. 150

[2] The Survey of Sickness, 1943-1952, by W. P. D. Logan and Eileen M. Brooke. Studies on Medical and Population Subjects, No. 12, General Register Office, London, 1957.

[3] Sampling Techniques: Their Application to Sickness Surveys, by D. K. Dale, Canadian Journal of Public Health, 1950 p. 490.

[4] The use of sampling methods for ascertaining total morbidity in the Canadian Sickness Survey, by Fraser F. Harris. Bulletin of the World Health Organization, Vol. 11, 1954.

[5] A Pilot Health Survey in West Bengal—1955, by S. J. Poti, M. V. Raman, S. Biswas and B. Chakraborty. Sankhya: Indian Journal of Statistics, Vol. 21, Parts 1 and 2, 1959.

[6] Sampling for the Danish Morbidity and Hospital Survey. By H. Hamtoft. Statistical Review No. 4, Sweden Central Statistical Office, 1955, Stockholm.

[7] Health Statistics from the US National Health Survey:
Series A-1: Origin and program of the US National Health Survey, May 1958
Series A-2: The statistical design of the health household-interview survey, July 1958.
Series A-3: Concepts and definitions in the health household-interview survey, September 1958.
In Series B are set out the analyses of the data collected, e.g. B-1, volume of physician visits; B-2, volume of dental care; B-3, number of persons injured; B-4, disability; B-5, selected survey topics; B-6, acute conditions; B-7, hospitalization; etc. US Dept. of Health, Education & Welfare, Washington, DC.

divided. Within the primary units segments each containing about six households have been defined. Each week a new random sample of about 120 such segments, comprising approximately 700 households, is drawn, of which all persons are interviewed concerning illnesses, injuries, chronic conditions, disability and other factors related to health. The samples for successive weeks can be combined for a quarter or a year. Continuous sampling thus permits of study of incidence and prevalence during the year, as well as more detailed analysis of a larger consolidated sample in respect of less common characteristics, as also for various geographical sections of the United States.

11.11 Size of sample

Nationwide sampling surveys by the interview method are costly. The sample size has therefore to be limited to the minimum considered adequate for the purposes of the survey and for the precision required. The purposes may include the study separately of weekly, montly, quarterly and annual figures as well as of the constituent areas or special population groups.

In the English survey a different monthly sample of 4000 adults was judged adequate, being equivalent to about 1 in 8000 persons for monthly rates, 1 in 2700 for quarterly rates and 1 in 700 for annual computations.

A weekly sample of only about 700 households for the entire population of 171 millions has been considered adequate for the United States. Over a 12-month period the plan provides for approximately 115,000 persons from 36,000 households in 6000 segments.

These sizes were determined on theoretical grounds to provide the desired degree of reliability. The sampling plan enables the error to be estimated numerically. For example it has been stated in the US National Health Survey Report that from the weekly samples taken during the three months July to September 1957 the estimated number of physicians' visits was 198.9 million in the whole country. The chances are about 70% that the difference would be less than 4.4 millions between the sample estimate and the figure which would have been obtained from a complete count.

CHAPTER 12

Organization of Statistics in a Health Department

12.1 Expanding role of health statistics service

We have already seen what the health statistics organization uses as basic data, how the raw material is fed into the statistical machine, if one may so term it, the fuel and the driving force it works on, viz. legislation and the community interest and participation. This chapter deals with its component parts; how the individual parts fit into a unified installation, how to remove the causes of friction and breakdown and how to keep it up to date.

Those health departments which established statistical units some two or three decades ago started modestly. There were hardly any mechanical gadgets. At that time, as indeed even today in some parts of the world, the statistical activities in the health departments were limited generally to vital registration and the study of statistical information derived from it. As a matter of fact, even when in some areas health departments were non-existent in the modern sense of the term, birth and death records, because of their legal value, were collected and compiled, and in some cases the function was transferred to the health department at a later date. A Division of Statistics existed because it was necessary to consolidate information on births, deaths, etc. pouring into and sometimes flooding the head office from a large number of constituent areas, individual families, institutions, communities and states. With the progress of time additional information began to flow in about communicable diseases, especially diseases declared notifiable under the law, thus broadening the functions of the statistical unit. A kind of prestige arose when noise-making machines for mechanical punching, sorting or tabulating the information were added. Of course it was a useful facility but it did not increase the intrinsic functions of the statistical unit.

Today the old order is changing radically and rapidly. We do not look at the statistical unit as a mere data processing installation or registering machine. On the contrary, enlightened health administrators regard it as a powerful tool or brain with which to study and describe the health situation, to seek aid in planning programmes and evaluation, and to undertake research projects. Today the functions of a statistical unit do not merely cover study of mortality or birth data but relate to the wider definition of health: the physical, mental and social aspects and, more specifically, the data on morbidity. The statistical unit now collaborates with many other sections of the health department at all stages, beginning from planning,

through action, implementation and finally evaluation. It is as it were the unit that does the "thinking through".

12.2 Expanding functions of health agency

The widening in statistical functions took place because the functions of the health agency were themselves expanding. The health department is no longer concerned solely with preventing epidemic outbreaks. New diseases, especially degenerative conditions, chronic diseases, mental disorders, and even events not necessarily related to disease such as alcoholism or accidents, are becoming the health officer's concern. The approach is that of positive health where the health officer is not merely concerned with "adding years to life but also life to years".

In brief, the changing concepts are broadening the field of action:

from acute to chronic disease,
from death prevention to sickness prevention,
from negative to positive health,
from physical wellbeing to mental and social wellbeing.

While, therefore, the task of improving accuracy and completeness of data continues, additional emphasis must be laid on comprehensiveness and on initiating newer programmes extending to medical care, industrial health, public health engineering, community planning, and other functions.

12.3 New statistical techniques

New statistical tools are now available. For instance, the application of modern sampling methods opens up a new avenue in health statistics in attaining measurable accuracy and by reducing time, cost and effort. New methods of data processing by mechanical devices have been invented. The potentialities of statistical work are thus considerably increased. The statistical unit should therefore develop a correspondingly positive attitude and be prepared to ease the ever-widening task of a health administrator and be ready to meet his demands. The statistician should help the health worker to plan through an expanding programme.

12.4 Structure, functions and responsibilities

The broadening of statistical coverage and the corresponding functions and responsibilites require that a properly staffed and equipped statistical unit should be created in each major health department and that due consideration should be given to defining:

1. structure, functions, responsibilities;
2. personnel required, their qualifications, status, duties, powers, in-service training, and
3. the equipment needed to render the various tasks feasible.

Many of these aspects raise complicated problems. Local conditions, available funds, past developments, or the degree to which the health administrator himself is alive to the usefulness of statistics, all affect the pattern of organization.

12.5 Centralization of statistical services

A central statistical unit in a health department is established for the purpose of providing certain statistical services to all units of the department. If the statistician is undertaking his duties and responsibilities solely in the spirit of serving other units, a central statistical organization will win confidence. But sometimes conflicts arise when certain sections of the health department insist on maintaining their own statistical units separately. Of course they have every right to ensure that their functions proceed smoothly. Nevertheless, the separation of services inevitably disintegrates statistical activities, leading to conflicts, unpleasantness, and sometimes chaos.

Among the many reasons in favour of a central statistical unit is the fact that duplication in the collection of data must be avoided, to save both time and money and that a high degree of co-ordination of the various programmes needs a central unit. Few public health departments have sufficient resources to employ several qualified statisticians for each programme. Even if money were available there would not be enough statisticians. It is also obvious that such statistical services as coding, editing, punching of cards, mechanical tabulation, graphic presentation, and maintenance of mailing lists and household lists, can best be performed in a central unit. By pooling the needs of all divisions one can justify rental or purchase of mechanical equipment, which in turn can lead to financial savings in the other tasks in a health department such as clerical work on payrolls, central registers, and so on.

Other less obvious reasons in favour of a centralized statistical unit are that as the primary goal of public health programmes is to protect the health of the community at large, the approach should be a broad one: the administrator should be able to look at the problem simultaneously from various angles. A general approach is difficult, if not impossible, to achieve without central co-ordination of statistical activities.

Without centralization the correlation of statistical data collected by different programme divisions is difficult, because the staff involved cannot be expected to be fully acquainted with the data available in the other departments and may not have ready access to them. Again, the need for establishing uniform population indices throughout the department cannot be met unless the population coverage by various health services is properly ascertained. A central unit obtains general recognition as an impartial producer of objective material and becomes known as a single source to which official bodies can go for data on various health activities.

With all these arguments one may feel that a central statistical unit could provide the most efficient pattern. On the other hand, a number of arguments have been advanced *against* centralization, such as:

1. Centralization may lead to remoteness from the operation levels, thus reducing the effectiveness of the work.

2. The director of the specific programme should have complete responsibility for the operation and should be free to obtain and utilize such statistical data as he wishes, without interference by other divisions or without

having to depend for his success on the mercy of any other division—the statistical division for instance.

3. A centralized statistical service may lead to costly administrative superstructure at the expense of the staff and services required at operating levels.

4. There may be delays and difficulties because the statistical staff is unfamiliar with the details of the programme.

5. A central statistical unit will be constantly faced with the difficult task of establishing priorities in rendering service to other units, particularly when it is also made responsible for budgets, finance, payroll records, and other matters which assume high priority.

6. A statistician in a central unit may become so heavily weighed down with responsibility for mere registration, issuing copies of birth and death certificates, compilation, or tabulation, and all the difficult administrative and legal problems involved, that he would have little time left for an analytical and thoughtful approach to the statistical needs of individual units.

The only formula for success is the spirit in which the central statistical unit undertakes its task of service to other units. If the right spirit is there, statistical subunits functioning in other programme divisions will tend to fuse into a single service. On the other hand, if that spirit is lacking, if the health statistician has not time or patience to study the needs of other units and through personal discussions invent ways and means of rendering ever-increasing service, a central statistical organization will soon disintegrate. Each programme director will then be tempted to safeguard his own interests by doing statistical work on his own.

12.6 The set-up of the central statistical unit

The central statistical unit in a major health department should function in three or four separate sections, under the charge of one qualified senior public health statistician.

12.6.1 *Section* 1: *Vital statistics* (If vital registration is the responsibility of the health agency). Its main functions are to

undertake routine collection of vital statistics, and receive daily, weekly, monthly, quarterly and annual reports from local areas on births, foetal deaths, deaths, premature births, marriages and divorces, etc., consolidate, tabulate, print and publish the statistical material in a presentable form,
assist local staff of adjacent regions by periodic reports,
adjust data for residence,
codify all deaths by cause,
prepare indices of health status and health activity,
maintain up-to-date tables, spot maps, graphs,
receive and maintain comparable figures of adjoining areas, countries and other regions of interest,
maintain files and indices or registers of births and deaths and issue copies of birth, death and marriage certificates and receive payment,

compile, tabulate and issue monthly, quarterly, and annual reports on vital statistics.

In this section a unit should exist to undertake inspection of actual collection of data at the periphery. This unit should assist in training local staff in compiling figures and undertaking propaganda to secure co-operation from the public.

12.6.2 *Section* 2: *Morbidity and health services reports*

To deal with morbidity data, surveys, and hospital statistics.

Ordinarily, this section should have two units — the one to deal with all epidemiological intelligence and notification of diseases, and the other with hospital statistics and statistics from public health institutions such as maternal and child welfare centres, clinics or schools. It should deal with chronic and acute infectious disease, adjust data for residence, codify and classify all sickness according to the international classification.

12.6.3 *Section* 3: *Planning and research*

To initiate studies and to plan statistical programmes.

In this section there might be units to deal separately with individual control programmes, as for tuberculosis, venereal diseases, and hookworm. This section should also undertake sampling surveys on the incidence of diseases that are not routinely reported, such as dental disease and nutritional deficiency. It should make surveys on nutrition status, cancer, and accidents, and study occupational health problems; calculate and maintain norms and average figures for the incidence of various diseases and death rates, and classify and interpret figures by age, sex and other relevant categories.

This section should collaborate with other divisions in the planning and conduct of their field projects and enquiries; analyse and evaluate the results, and advise on statistical methodology. In particular, it should create record forms and procedures for collecting data on services of various divisions of the department of health. The preparation of estimates of total sickness should be an important function of this section.

This section also maintains the library of statistical reference and sources of data and special statistical reports.

12.6.4 *Section* 4: *Mechanical processing*

In the larger statistics divisions where mechanical equipment is installed, it may be expedient to have a separate tabulation section to meet the needs of the entire health department. Arrangements will include plans for routine reports in connexion with vital statistics, cancer morbidity, occupational health, accidents, maternal and child health, school health statistics, venereal diseases, tuberculosis, and other local health department activities. Through the use of punch cards, central registers could be maintained on many subjects.

12.7 Status and responsibilities of the chief health statistician

The Governing Council of the American Public Health Association in

the report "Educational qualifications of public health statisticians" recognizes that statistics is a "scientific system or method for the collection, compilation, description, organization, analysis, interpretation, and presentation of data". It is the thorough knowledge of this scientific system that characterizes the statistician. The professional statistician is to be distinguished from the many non-professional or clerical persons engaged in statistical work. The distinguishing features are:

1. knowledge of the theory and methods of health statistics;
2. the professional nature of duties, which include responsibility for the collection, processing, and analysis of data, and for selecting statistical techniques to be employed.

The professional statistician may be considered in one or another category according to whether his primary function is the registration of vital records or the analysis and interpretation of statistical findings. As chief of a major statistical unit engaged primarily in analytical work in co-operation with other units of the health department, the statistican may or may not have responsibility for vital registration. His duties generally are: to plan and supervise research and statistical projects in public health and related fields, to direct data collection and compilation, and to analyse data related to public health for the purpose of appraising and preparing reports on the social, medical, and financial phases of the programmes; to plan, direct, and supervise the preparation of all reports; to edit publications; to prepare the main text and interpretation of reports; to make such studies of health statistics records as may be required to comply with requests for information by individual, private and public organizations in the field of public health; to plan and direct special studies and surveys; to assist through the use of factual data in making amendments to, and formulating policies and procedures for the amdinistration of the law; to act as consultant in all statistical problems and procedures in the health department.

Some of the junior statistical officers may be administratively assigned to work in another health department unit. Nevertheless, their chief in the professional sense should be the chief of the statistical organization. Otherwise it will be difficult to ensure that the overall statistical programme of the health department is co-ordinated and integrated.

12.8 Training of health statistical personnel

The statement "good statistics require good statisticians" to be entirely correct should be amplified to include the observation that good statistics also require good statistical administrators, good field officers, good coding and editing clerks, good machine (calculating machine and punch card equipment) operators, good graphic artists, some of whom although not trained statisticians, contribute very substantially to the success of operations and the quality of the data. Any health statistical unit of reasonably large size (state or national level) should therefore provide the facilities for training these categories of personnel to ensure a steady flow of trained staff into its service. A training programme should be oriented primarily to the needs of

the clerical and junior professional statisticians on whom the routine burdens of collection and compilation are heaviest and for whom training opportunities outside are perhaps non-existent. Special attention should be paid to the preparation of departmental manuals setting out detailed instructions for specific items of work, viz. the coding of data, editing, filling up record cards or schedules, tabulation procedures, etc. to ensure a continuous programme of inservice training.

In order that each country should have at least a nucleus of health statistical workers with the necessary modern skill and knowledge to train their colleagues and students, international agencies and foundations collaborate with the countries through the award of fellowships in vital and health statistics, and in conducting seminars and training centres on these subjects.

From 1950, a number of seminars or training centres have been conducted by the United Nations and the World Health Organization and host governments in Chile, Egypt, Ceylon, Japan, Afghanistan, Viet-Nam, French Equatorial Africa and Venezuela. Reports on the activities of these training centres describe in some detail the contents of the courses.[1]

National Committees on Vital and Health Statistics as well as associations of public health workers, should also undertake to foster inservice training programmes. The training so afforded does not generally overlap what is given in academic institutions where of course the foundations of statistical theory are and should be laid.

12.9 Statistical equipment

The need for statistical equipment varies according to the nature and volume of the services expected from the health statistical unit, such as processing vital statistics records, analysis of data, and undertaking special field surveys. Thus, while listing, adding and calculating machines are essential, the need for tools to process mechanical data should be judged from an analysis of the job itself, the time element, cost factor, and facilities at hand. For a discussion of the problems involved, see "General Problems of Data Processing" and of "Publication" in the UN "Handbook of Statistical Organization" (Series F, No. 6, 1954).

The statistical unit should also have ready access to textbooks, statistical reports, documents, etc. dealing with health statistics and related problems. In order to simplify the collection of suitable material and to help in determining costs, etc. some relevant information containing lists of books and addresses of various firms supplying statistical equipment, are given in Appendix I.

[1] See UN Statistical Papers Series M, Nos. 9, 12, 13, 15 and 24 for the training imparted at Chile 1950, Ceylon 1951, Egypt 1951, Japan 1952, and Afghanistan 1954.

III. ANALYSIS AND PRESENTATION OF DATA

CHAPTER 13

Statistical Classification of Health Data

13.1 Need for classification

The first step in the analysis of data is to establish a classification system so that items which need not be distinguished from each other are put together in groups. Each item of information is thus arranged in such a way that "like is associated with like" and a limited number of mutually exclusive classes permits scientific generalization. Sometimes the categories are determined by the nature of the information. For example, only four statements can possibly be made about the sex of an individual: male, female, intersex, unknown. For a number of frequently ascertained characteristics, classifications have been recommended for international adoption by the United Nations and the World Health Organization. These are described below. In the absence of any international classification, the national census classifications should be followed when applicable, so as to provide comparable data. In each case it is necessary to keep in mind the needs of the consumers of particular statistics. For this purpose they, as well as experts in the field, should be consulted. Usually, the internationally recommended classification has to be extended to suit national or local conditions, but the extension must ensure that categories required for international comparison are not lost.

13.2 Classification of diseases, injuries and causes of death

The cause of death is defined as "the morbid condition or disease process, abnormality, injury or poisoning leading directly or indirectly to death. Symptoms or modes of dying such as heart failure, asthenia, etc., are not considered to be causes of death for statistical purposes."

Cause-of-death statistics are most important to the health worker. The objective being prevention, primary tabulations are concerned with the *underlying* cause of death, defined as:

(a) the disease or injury which initiated the train of morbid events leading directly to death, or

(b) the circumstances of the accident or violence which produced the fatal injury.

The usefulness of mortality statistics is enhanced by cross-classifying causes of death by age and sex, as well as by such other pertinent factors as place of occurrence, certifier of cause, hospitalization, and so on.

The aims of a statistical classification of disease were summarized a century ago by William Farr as follows:

"The causes of death were tabulated in the early Bills of Mortality (Tablesmortuaires) alphabetically; and this course has the advantage of not raising any of those nice questions in which it is vain to expect physicians and statists to agree unanimously. But statistics is eminently a science of classification; and it is evident, on glancing at the subject cursorily, that any classification that brings together in groups diseases that have considerable affinity, or that are liable to be confounded with each other, is likely to facilitate the deduction of general principles.

Classification is a method of generalization. Several classifications may, therefore, be used with advantage; and the physician, the pathologist, or the jurist, each from his own point of view, may legitimately classify the diseases and the causes of death in the way that he thinks best adapted to facilitate his inquiries, and to yield general results.

The medical practitioner may found his main divisions of diseases on their treatment as medical or surgical; the pathologist, on the nature of the morbid action or product; the anatomist or the physiologist on the tissues and organs involved; the medical jurist, on the suddenness or the slowness of the death; and all these points well deserve attention in a statistical classification.

In the eyes of national statists the most important elements are, however, brought into account in the ancient subdivision of diseases into plagues, or epidemics and endemics, into diseases of common occurrence (sporadic diseases), which may be conveniently divided into three classes, and into injuries the immediate results of violence or of external causes."

13.2.1 *Historical development*

The development of the International Statistical Classification has a long history of intensive work dating back to the pioneering attempts of François Bossier de Lacroix (1706-1777), better known as Sauvages, William Cullen (1710-1790), William Farr (1807-1883) and Jacques Bertillon (1851-1922).

During the First International Statistical Congress, Brussels, 1853, a request was made to William Farr of England and Marc d'Espine of Geneva, to prepare a uniform classification of causes of death applicable to all countries, and their list as adopted at the next Congress in Paris contained 139 rubrics. The list was subsequently revised in 1874, 1880 and 1886. In 1891, the International Statistical Institute, the successor to the Congress, appointed a committee with Jacques Bertillon of Paris as chairman, to revise the classification. Bertillon's classification represented a synthesis of English, German and Swiss classifications and contained 161 titles. The French Government convened in 1900 the First International Conference for the Revision of the International Statistical Classification of Causes of Death and adopted a classification consisting of 179 groups, together with an abridged classification of 35 groups. The desirability of decennial revisions was recognized. Substantial contributions were made by Jacques Bertillon who continued to be the guiding force in the revisions of 1900, 1909, and 1920. Further revisions took place in 1929, 1938, 1948 and the last, the 7th revision, in 1955. The next is due in 1965.

13.2.2 *Structure of the International Statistical Classification (Seventh Revision)*

In the International Classification now in use, the broad groups are similar to those of the previous lists. The classification is arranged in seventeen main sections as follows:

I. Infective and Parasitic Diseases
II. Neoplasms
III. Allergic, Endocrine System, Metabolic, and Nutritional Diseases
IV. Diseases of the Blood and Blood-forming Organs
V. Mental, Psychoneurotic, and Personality Disorders
VI. Diseases of the Nervous System and Sense Organs
VII. Diseases of the Circulatory System
VIII. Diseases of the Respiratory System
IX. Diseases of the Digestive System
X. Diseases of the Genito-urinary System
XI. Deliveries and Complications of Pregnancy, Childbirth, and the Puerperium
XII. Diseases of the Skin and Cellular Tissue
XIII. Diseases of the Bones and Organs of Movement
XIV. Congenital Malformations
XV. Certain Diseases of Early Infancy
XVI. Symptoms, Senility, and Ill-defined Conditions
XVII. Accidents, Poisonings, and Violence

Two alternative classifications of items included in Group XVII have been provided:

E XVII. Alternative Classification of Accidents, Poisonings, and Violence (External Cause)
N XVII. Alternative Classification of Accidents, Poisonings, and Violence (Nature of Injury)

The E and N classifications are independent and either or both can be used.

The sections deal first with diseases caused by well-defined infective agents, followed by categories for neoplasms, allergic, endocrine, metabolic and nutritional diseases. Most of the remaining diseases are arranged according to their principal anatomical sites. Special sections are provided for mental diseases, complications of pregnancy and childbirth, certain diseases of early infancy, senility and ill-defined conditions including symptoms. Lastly a dual classification of injuries is provided.

The detailed classification (7th Revision) consists of 612 categories of diseases and morbid conditions in addition to 153 categories provided for the classification of the external cause of injury, and 189 categories for the characterization of injuries according to the nature of the lesion. Each category is given a three-digit code number and some categories are further divided into subcategories with four-digit code numbers. An Intermediate List of 150 causes ("A" List) and two abbreviated lists of 50 causes each (Lists "B" and "C") have also been provided for tabulation purposes.

Volume 1 of the WHO "Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death" contains the Detailed List of three-digit Categories, the Tabular List of Inclusions (defining the content of the categories) and four-digit subcategories, the International Form of Medical Certificate, and rules for classifying the underlying cause. Volume 2 is an alphabetical index of diagnostic terms coded to the appropriate categories.

13.2.3 *Obligations under WHO Regulations*

Today the classification and publication of cause-of-death statistics is governed by World Health Organization Nomenclature Regulations (see Appendix IIIa) which stipulate the use of the International Statistical Classification of Diseases, Injuries and Causes of Death. The Regulations also call for the use of the International Form of Medical Certification of Cause of Death and lay down the procedure for selecting the cause for tabulation.

As a first step mortality data must be coded in accordance with the code numbers provided for each cause of death in the Classification (Article 2), using the Tabular List of Inclusions and Alphabetical Index. WHO Regulations specify that statistics of cause-of-death for the country as a whole shall be published in accordance with the list of three-digit categories, or if this is not possible, in accordance with the Intermediate List of 150 cause groups. If only the Intermediate List is published, causes of death should still be coded first according to the Detailed List before they are grouped. For geographical subdivisions of a country, the use of the Intermediate List or the Abbreviated List of 50 Causes is recommended, (Appendix IV).

13.2.4 *Medical certification of the cause of death*

Medical certification of cause of death is an essential part of good health statistics. The international form recommended for this purpose is reproduced below. It is usually incorporated in the death registration form, and is designed so that the certifying physician may indicate clearly what he considers to be the underlying cause.

The form consists of two parts, I and II, which are:

I. (a) Direct cause,
   (due to)
   (b) Intervening antecedent cause,
   (due to)
   (c) Underlying antecedent cause;

II. Other significant conditions contributing to the death but not related to the disease or condition causing it.

For reporting the sequence of the direct and antecedent causes, provision is also made for recording the interval between the onset of the disease or condition and the time of death.

Of course it is not sufficient merely to ensure that physicians use the International Form. A continuous programme of education and propaganda is required for the medical profession to ensure that the forms are properly

INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

CAUSE OF DEATH		Approximate interval between onset and death
I *Disease or condition directly leading to death*[1]	(a)	. . . . .
	due to (or as a consequence of)	
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b)	. . . . .
	due to (or as a consequence of)	
	(c)	. . . . .
II *Other significant conditions* contributing to the death, but not related to the disease or condition causing it	. . . . .	. . . . .
	. . . . .	. . . . .

[1] This does not mean the mode of dying, e.g., heart failure, asthenia, etc. It means the disease, injury, or complication which caused death.

completed. A pamphlet "Medical Certification of Cause of Death" has been published by WHO for the instruction of physicians in the use of the International Form of Medical Certificate of Cause of Death.

13.2.5 *Rules for classification of cause of death*

The classification of cause of death is relatively simple when only one cause is involved. In many cases, however, two or more conditions may contribute to death. In such cases only one cause is selected for tabulation, viz. the underlying cause of death (as defined in Section 13.2). The responsibility for indicating the train of events is placed on the physician signing the certificate who indeed is in a better position than any other individual to make the decision. When more than one condition is reported, the selection of the cause to be tabulated is made according to the following general rule:

Select the underlying cause, i.e. the starting point in the sequence of events leading to death. In a properly completed certificate, the conditions forming this sequence will be entered in order in Part I with the underlying cause stated on the lowest used line.

When the certificate is improperly completed, i.e. when it is clear that the information is inconsistent, incomplete or equivocal, the procedure is to seek, as far as possible, additional information or clarification. Failing this, the Manual provides certain "selection rules" that reflect the certifier's opinion of the underlying cause with greater accuracy than would have been achieved by an automatic selection of the condition stated in the lowest used line of Part I of the certificate.

13.2.6 *Confidentiality of cause of death*

WHO Nomenclature Regulations (Article 11) prescribe that "As far as possible, the administrative procedure for the completion, transmission, and statistical treatment of the medical certificate of cause of death shall ensure protection of the confidential nature of the medical information contained therein."

13.2.7 *Applicability to developing areas*

In countries without an adequate number of doctors, statements made about cause of death by non-medical persons will necessarily be of a lower order of accuracy. In many cases no specific cause is given; only symptomatic and ill-defined descriptions appear such as fever, convulsions, women's disease. The WHO International Classification of Diseases provides code numbers even for statements of this kind; most of them appear under the heading "Symptoms, senility, and ill-defined conditions": code numbers 780-795. Nevertheless, when a group of symptoms is recorded, the need will arise for adapting the Classification to classify complexes of symptoms. This can be done by providing new four- or five-digit code numbers under appropriate code headings.

There is still some confusion regarding the applicability of the International Classification in developing areas and attempts are sometimes made to develop separate lists. It has already been mentioned that the 1955 revision of the International Classification provides a code number for any kind of statement that can possibly be made about death including vague, symptomatic, and ill-defined statements. Every such statement could therefore be coded in the Statistical Office according to the Detailed List. Whatever the stage of development of the country there is at present no substitute for the Detailed International List. Until the shortage of doctors is remedied, there will be deaths for which the only possible statement is "cause of death nnknown". They should be coded and classified accordingly. Separate code uumbers are provided for deaths from unknown cause—during pregnancy, childbirth and the puerperium, and in the first four weeks of life.

13.2.8 *Classification according to "certifier"*

Whenever possible certification of cause of death should be carried out by the physician [1] who attended the deceased, and on the International Form (see Section 13.2.4). In the absence of a physician, the statement of the coroner, nurse, midwife or lay persons registering the death is accepted. The reliability of cause-of-death data varies with the proportion of deaths certified by physicians in attendance. For evaluating cause-of-death statistics, therefore, information about the "certifier" is essential. Certifiers can be classified in the following categories: medical attendant; medical examiner; pathologist; non-medical person; not stated.

[1] In this context "physician", "medical attendant", "medical examiner" imply persons qualified in the Western system of medicine.

The non-medical categories could be further sub-divided into coroner (non-medical), midwife, nurse or layman.

WHO Nomenclature Regulations require that countries "where coverage of medical certification of cause of death is incomplete or limited to certain areas shall, in publishing statistics of causes of death, indicate:

(*a*) areas in which medical certification is deemed adequately complete; and/or

(*b*) areas with incomplete coverage of medical certification, tabulating medically certified deaths separately from other deaths.

13.2.8.1 *Need for separating statistics from various sources*

Yves Biraud has emphasized by an interesting illustration the need for keeping separate the cause of death statistics according to the type of certificate (medical diagnosis versus lay person's statement). He says that "if the water supply of a community includes both a small spring of pure water and abundant but dirty water from a river, nothing will be gained by mixing them . . . the addition of even a little dirty water to the clear will be sufficient to spoil it." [1] The need for tabulating medically certified deaths separately as stipulated in Article 3 of the WHO Nomenclature Regulations is therefore fundamental.

13.3 Classification of morbidity statistics

A century ago William Farr recognized the desirability of extending the use of the Classification List to diseases, "which though not fatal, cause disability in the population, and now figure in the tables of diseases of armies, navies, hospitals, prisons, lunatic asylums, public institutions of every kind, and sickness societies, as well as in the census of countries like Ireland, where the diseases of all the people are enumerated." In 1928, Roesle of Germany suggested the adaptation of the 1920 International List of Causes of Death for use in the classification of morbidity statistics. But it was not until 1948 that a single comprehensive list for classifying both mortality and morbidity statistics was agreed upon for international use.

The classification of morbidity statistics is also governed by WHO Regulations which stipulate (Article 13) that the cause of illness should be coded in accordance with the International Statistical Classification of Diseases, Injuries, and Causes of Death, with or without four-digit subcategories, using for the purpose the Tabular List of Inclusions and Alphabetical Index. For purposes of publication either the Detailed List or the Intermediate List of 150 causes should be used or such special list appropriate to the purpose of the statistics concerned as may have been recommended by the World Health Assembly. If they are published in another form the categories selected shall be so arranged that by suitable grouping they can be related to one of the above lists. The WHO Manual provides a Special

[1] A method for the recording of crude causes of death by laymen in underdeveloped areas, by Yves Biraud. Unpublished document WHO/HS/60. Geneva, 1956.

C List of 50 causes for the tabulation of morbidity for social security purposes.

As far as possible, morbidity statistics should be cross-classified by the same sex-age groupings as recommended for mortality statistics.

13.3.1 *Supplementary classification for special admissions*

Admissions to hospitals and health centres can occur for reasons other than disease or injury, e.g. for medical or special examination, examination after disease or operation, suspected carrier of infective organisms, infants born in hospital, or for prophylactic inoculations. In order to classify admissions of such apparently healthy persons a special system of code numbers has been provided in the WHO Manual in which the first digit has been replaced by the letter "Y". The supplementary classification also contains a classification of the causes of stillbirth (codes Y30—Y39). These supplementary classifications are indispensable in the statistical treatment of data from many health institutions.

13.3.2 *Use of the International Classification of diseases as a diagnostic index*

A diagnostic index is a file of individual diagnoses expressed in code numbers and carrying reference to the clinical histories dealing with the same diagnoses. To serve this purpose satisfactorily the diagnostic list used for classifying and indexing should be as specific as possible. It should consist of titles denoting separate clinical entities. Several lists of this type are in existence, one such being the Standard Nomenclature of Diseases and Operations. With certain extensions the International Statistical Classification of Diseases, Injuries, and Causes of Death can be adapted for this purpose. One example of this is the Diagnostic Index Coding Manual prepared by the US Veterans' Administration for use in hospitals for diagnostic indexing and case-finding.[1] The manual is the result of experience gained in the United States and has been drawn up by a working party including medical record librarians, physicians and statisticians established by the US Committee on Vital and Health Statistics.

13.4 Classification of live births and foetal deaths

Recommendations for the classification and tabulation of live births and foetal deaths are contained in Part 4 of the United Nations "Principles for a Vital Statistics System". The live birth tabulations recommended are:

Live births classified by place of occurrence, by attendant at birth (physician, midwife, nurse, other, not stated), by calendar month of occurrence, by sex and legitimacy (legitimate, illegitimate, not stated); by age of mother and live birth order (in relation to all previous live-born issues of the mother).

[1] Diagnostic Index Coding. Part Four Section I. US Veterans' Administration Department of Medicine and Surgery Manual M-3. January 1957, Washington, D.C.

The foetal death tabulations recommended are:

By place of occurrence, by sex and period of gestation; late foetal deaths by sex and legitimacy, by age of mother and total birth order.

A Sub-committee of the WHO Expert Committee on Health Statistics[1] has made recommendations for the classification and tabulation of live births and foetal deaths according to period of gestation. The selection of the number of weeks of gestation to be included in the tabulations recommended was made after studying current data on foetal deaths and live births in various countries. It was noted that very rarely are infants reported as being live-born before the 20th week; at 28 weeks there are, in England, approximately three times as many live births as there are foetal deaths and, judging from this experience, this appeared to be about the time when the live-born began to have a fair chance of survival. From the clinical standpoint, it was felt that dividing lines at the 20th and 28th weeks could reasonably be used since clinical conditions affecting live birth and foetal death change appreciably at about these periods.

For tabulating all live births, irrespective of the period of gestation, the following classification has been recommended:

Less than 20 completed weeks of gestation	Group I
20 completed weeks of gestation but less than 28	Group II
28 completed weeks of gestation and over	Group III
Gestation period not classifiable in Groups I, II and III . .	Group IV

The period of gestation is measured from the beginning of the last menstruation.

The tabulation of foetal deaths in the same groups is recommended; Group I being called "early", Group II "intermediate", and Group III "late" foetal deaths.

For international statistical purposes, live births and foetal deaths should be classified into Groups I, II, III and IV as defined above. The term "stillbirth" should be retained only if essential for internal use within a nation (see Section 15.3).

13.5 Age classification

Age is defined as the estimated or calculated interval between the date of birth and the date of occurrence of the event (death, attack of disease, delivery of a child) and is expressed in the largest possible completed units of time, such as years, months, days or hours of life, as appropriate.

Age can be classified in various ways depending on the purpose of the study. For instance population data are generally classified by age in the following categories:

Under 1 year; 1-4 years; 5 year groupings from 5-74 years; 75 years and over; and 'not stated'.

In areas where it is not possible to obtain ages of persons enumerated in

[1] WHO Technical Report Series No. 25, 1950.

terms of individual years, the United Nations recommend the use of the following age groups to afford a rough differentiation:

Infants under 1 year; young children between 1 and 5 years of age; older children (6-15 years); men in the economically active ages and women in the childbearing ages (16-45 years), and men and women beyond these ages.

Age classification is essential for several statistical indices, e.g. life tables, age-specific morbidity rates, etc. Tabulation of live births is needed by age of mother in conjunction with the order of birth, legitimacy, etc.

For statistics of live births, classification of mother's age can begin with 'under 15 years', continuing in five-year age groups through 15-19, to 45-49 and end with 50 and over. A separate category is provided for age not stated.

For publishing statistics of causes of death, age classification usually begins with an under-one-year group and proceeds in single years through four years, thence in five-year age groups through 84, with two terminal groups of 85 and over and age not stated. More specifically the WHO Regulations, Article 6 stipulates that one of the following age groupings shall be used:

(a) for general purposes:
  (i) under 1 year, single years to 4 years inclusive, five-year groups from 5 to 84 years, 85 years and over;
  (ii) under 1 year, 1-4 years, 5-14 years, 15-24 years, 25-44 years, 45-64 years, 65-74 years, 75 years and over;
  (iii) under 1 year, 1-14 years, 15-44 years, 45-64 years, 65 years and over;

(b) for special statistics of infant mortality:
  (i) by single days for the first week of life (under 1 day, 1, 2, 3, 4, 5, 6 days), 7-13 days, 14-20 days, 21-27 days, 28 days up to but not including 2 months, by single month of life from 2 months to 1 year (2, 3, 4, . . . 11 months);
  (ii) under 7 days, 7-27 days, 28 days up to but not including 3 months, 3-5 months, 6-11 months;
  (iii) under 28 days, 28 days to 11 months inclusive.

If age groupings are published in greater detail than in one of the groupings specified above, they shall be so arranged as to allow condensation into one of these groupings.

While the above recommendations cover the publication of routine mortality and morbidity statistics, the age grouping for special morbidity studies may have to be different, but should be capable of reduction to the grouping (a) (iii) above.

13.6 Classification by marital status

The following categories have been suggested by the United Nations:

A. *Single*, that is all persons never married.

B. *Married*, including all persons formally married, persons in stable *de facto* unions, and persons living apart from their spouses but still regarded as forming a marital union.

C. *Widowed*, not remarried.

D. *Separated*, or *divorced*, not remarried, including persons whose marriages have been annulled, persons legally separated and persons formerly living in stable *de facto* union but no longer regarded as forming part of such a union.

E. *Marital status not stated.*

More detailed classifications within categories B and D may be warranted in many countries.

Classification of marital status could be shown separately for ages "under 15 years" and "15 years and over".

13.7 Classification by occupation and industry

Health is affected by the conditions in which an individual works, especially when the industry or occupation involves extra health hazards. A study of morbidity and mortality in relation to occupation or industry is therefore important. A number of studies have appeared on this subject, of which an excellent review by Jean Daric has been published by the United States National Office of Vital Statistics.[1]

Statistical problems in this field were reviewed by the International Labour Office in 1930.[2] Among the important recent studies mention should be made of those by the Registrar General of England and Wales[3], by W. P. D. Logan[4], and a study in the United States by I. M. Moriyama and Lillian Guralnick.[5] In studies of this kind the need arises for a suitable classification of occupation or industry. Furthermore, persons engaged in the same occupation may suffer very different health hazards depending on their status, i.e. whether "employer", "employee" or "worker on own account". Although various terms such as social status, industrial status, or occupational status, have been used, the terms now accepted for international usage are defined below:[6]

"*Occupation* is the trade, profession, or type of work performed by the individual."

"*Industry* (branch of economic activity), refers to the activity of the establishment in which an individual is employed or the kind of business he operates."

"*Status* (as employer, employee, etc.), refers to the status of an individual

[1] Mortality, Occupation and Socio-economic Status, by Jean Daric. (Vital Statistics—Special Reports. Selected Series, Volume 33, No. 10, Washington, D. C. (1951).

[2] Statistical Methods for Measuring Occupational Morbidity and Mortality. International Labour Office Studies and Reports, Series N (Statistics) No. 16, Geneva, 1930.

[3] Registrar General's Decennial Supplement. England and Wales 1951. Occupational Mortality, Part II, Volume I.

[4] Social Class Variations in Mortality, by W. P. D. Logan. Public Health Reports, Vol. 69, No. 12, pp. 1217-1223, December 1954.

[5] Occupational and Social Class Differences in Mortality, by I. M. Moriyama and L. Guralnick, in Trends and Differentials in Mortality. Proceedings of a Round Table at the 1955 Annual Conference. Milbank Memorial Fund, New York.

[6] UN Handbook of Vital Statistics Methods. Studies in Methods, Series F, No. 7, 1955, New York.

with respect to his employment, i.e. whether he is an employer, worker on own account, employee, or unpaid family worker."

For the purpose of establishing health statistics indices, the classification of retired persons should correspond to that used in the national census of population.

13.7.1 *Classification of occupations*

An International Standard Classification of Occupations, established by the International Labour Office and the United Nations, has ten major groups:

1. Professional, technical and related workers
2. Managerial, administrative, clerical and related workers
3. Sales workers
4. Farmers, fishermen, hunters, lumbermen and related workers
5. Workers in mine, quarry and related occupations
6. Workers in operating transport occupations
7. Craftsmen, production process workers and labourers not elsewhere classified
8. Service workers
9. Occupations unidentifiable or unreported
10. Members of the armed forces

Although the classification is recommended specifically for population census data it can also be utilized, where appropriate, for other types of statistics. The ten major groups have been further subdivided into 2-digit categories.[1] Where health data have to rely on the census population as the base, correspondence can only be achieved if a similar classification is followed. In special investigations a more detailed occupational classification will be necessary. In England and Wales for instance, every occupation, of which there are many thousands, is assigned to one or another of 586 occupational unit groups. Each of these groups is assigned to one or another of five social classes graded as follows:

Class I - Professional, etc., occupations
Class II - Intermediate occupations
Class III - Skilled occupations
Class IV - Partly skilled occupations
Class V - Unskilled occupations

13.7.2 *Industry classification*

The recommended classification is the "International Standard Industrial Classification of all Economic Activities (ISIC)". This is constructed on the decimal system, the first digit of which provides nine major divisions:

Division 0 - Agriculture, Forestry, Hunting and Fishing
Division 1 - Mining and Quarrying
Divisions 2-3 - Manufacturing

[1] See: International Statistical Classifications of Occupations, International Labour Office, 1958, Geneva.

Division 4 - Construction
Division 5 - Electricity, Gas, Water and Sanitary Services
Division 6 - Commerce
Division 7 - Transport, Storage and Communication
Division 8 - Services
Division 9 - Activities not adequately described

The 3-digit subgroups provide the most detailed classification. The problems of its interpretation, history, structure, application, etc. and its adaptation to national needs are discussed in a UN publication.[1]

13.8 Other recommended classifications

Space does not permit comment on similar classifications recommended in respect of illegitimacy, literacy, level of education, status, etc. (see Sections 3.11.5, 7, 8, 10, 11). The progress made in the development of such classifications is summarized in the UN Directory of International Standards, Statistical Papers, Series M, No. 22, 1955, New York.

[1] See: International Standard Industrial Classification of all Economic Activities. UN Statistical Papers, Series M, No. 4, 1949, New York. See also: International Standards in Basic Industrial Statistics. UN Statistical Papers, Series M, No. 17, 1953, New York.

CHAPTER 14

Handling and Processing Statistical Information

14.1 Introduction

In the course of a statistician's work a stage is reached when information collected separately for each individual born, healthy, sick or dead, begins to pile up. During the stage of collecting the data, he may have to depend on the co-operation of a large number of field staff and respondents, but once the information has been turned over to him, the responsibility of doing something with it rests entirely on him. It has been the unfortunate experience of several statisticians that frequently the information was collected without expert statistical advice and big boxes containing registers, slips, schedules or cards were left in the room for attention. On the face of it, sometimes, the job looks colossal.

An important point is that in any task involving a mass of information the statistician must, from the very start, so plan the work that each individual is, as it were, converted into a separate card. By this means the statistician, sitting in his own office, has the whole population at his perfect command in so far as the statistical manipulation of those people, live or dead, is concerned. Even the dead can be made statistically alive if information is put on suitable cards. The recording of information on loose leaves of paper or on single lines of registers is to be deprecated unless it is a step towards preparing a separate card for each event or for each individual.

There are a variety of cards in use, their sorting and counting depending upon manual methods or on the use of mechanical gadgets from the simplest long needle and clipper to the million dollar electronic equipment. The factors to consider in handling data are: the job itself, i.e., the number of records; uses of the records; time element; cost factor and the facilities available. But given the job, one should consider using services which would not only ease the task but bring about economy in cost and efficiency. Commercial firms are able to thrive on the sale of sorting, counting and tabulating equipment because they successfully show economy by its use. We may distinguish between four types of records:

1. Vital statistics, records of births, deaths, etc., if handled by the health department. The cards may run into millions and if a central processing unit is to take charge, electrically operated equipment is a necessity. But in many countries of the world the task has so far been carried out without such equipment.

2. Hospital records.
3. Health department service records collected routinely.
4. Records obtained in special investigations, e.g. morbidity and nutrition surveys.

The steps in data handling and processing are:

1. Collection of data.
2. Scrutiny of the data for adequacy, completeness and accuracy.
3. Sorting or classification into classes or groups.
4. Computing the necessary statistical indices.
5. Tabulation and presentation.

14.2 Guiding principles for data collection

1. The plan should be flexible, i.e., provision should be made for subsequent changes to meet unforeseen situations.

2. The plan should be adaptable to local conditions — a system of data collection which works well in a highly industrialized community may not suit a less developed community. Similarly a kind of system which works well in one part of a large country may not necessarily do so in another part, as for instance the maintenance of disease registers.

3. Over-elaboration should be avoided — a start should be made in a simple manner covering only basic needs.

4. The probable result of a given course of action on the respondents should be anticipated and the collection designed with a view to securing the desired results.

5. The plan should be practicable within the limitations of available funds and trained personnel. This includes expenses for data processing.

6. The needs which the data are expected to fulfil should be stipulated — can these needs be fulfilled by data collected in a different manner or from some other source?

7. Plans should be feasible, i.e., the information should be obtainable in a form which can and will be reported; consider whether the respondent has records which will enable him to report the requested information. Questions of diagnosis of disease, memory factor, etc., should also be considered.

8. Duplication of effort and the possibility of encountering unfavourable reaction should be considered.

9. The respondent group should be clearly identified, i.e., the best source for securing the desired information should be ascertained.

10. The extent of coverage, its frequency and timing should be stipulated. Timing should suit the convenience of the respondent.

11. A pre-testing of the data-collecting procedures should be carried out to detect sources of error and problems of practicability. If it is found that the procedure presents difficulties to the respondent, the plan should be modified to take that into account. The plan may be discussed with the respondents.

12. Methods of securing good public relations should be studied and adopted. These may substantially decrease the cost of the work and improve

the response rate. On the other hand, bad public relations may wreck the plan. The use of voluntary agencies, press, magazine articles, journals and so on should be explored.

13. Bad reactions can result from the schedule itself. For instance, if questions on income tax are asked by an enumerator, the respondents may have a feeling that the confidential nature of the data will not be respected and so refuse to co-operate. This schedule should be designed attractively with clear instructions, so that the respondent sees that the statistical office making the survey knows its business.

14. Anonymity of the respondent should prevail in case the information given may be harmful to him. On the other hand, if the respondent is not identifiable, follow-up information is impossible.

15. The definitions and terminology should be such that they can readily be understood by the respondents while conforming to national and international standards and recommendations.

16. Clear yet brief instructions should accompany the schedule. In some cases it may be better to put the instructions near the item to which they refer, so that they stand a better chance of being read than if they are on a separate sheet of paper or on the reverse side. Notes on where to return the form and how to return it and who is to make the survey, should be included.

17. The form used should be designed for processing efficiency, i.e., to meet the requirements of coding and punching, etc. The yes, no, or multiple choice types of answers are very simple to code and handle for machine tabulation.

18. The staff used for data collection should be properly selected, trained, supplied with manuals or written instructions and their work should be supervised in the field. One helpful device frequently used is for the enumerators, while in training, to interview one another and fill out schedules.

19. Statistical information collected should be made public only in a form which does not reveal the identity of the respondents.

20. Staff should carry indentification cards with them when visiting households.

14.3 Data processing tools

Data processing tools are of two kinds, viz. manual or mechanical.

For small and simple jobs, manual methods are found more economical and often faster than machine methods. In areas where human labour is cheap, economy and availability of resources may dictate the use of manual methods. In manual processing, sorting is carried out by reading the document or by its distinguishing colour, shape or size. The oldest and rather time-consuming method is that of tally sheets, the counting or recording being done by a series of marks, one for each item. But many auxiliary aids such as sorting cabinets or trays, or a peg-bar device are now used to speed up the operation. The latter is so called because by means of a metal bar 20 to 30 inches long, equipped with equally spaced pegs, 50 to 60 individual records can be held in position. A glide ruler facilitates the consolidation

of information. The method has been found to be fast, simple to organize and relatively cheap and accurate.

Another device is a card with marginally punched holes. The information is recorded by slotting along the edges. When a sorting needle is passed through a particular hole in a group of cards and the needle lifted, all cards slotted in that position drop out. When the same batch of cards is required to be sorted rapidly for cross-classification of data, this system is economical. For a discussion of the applications of this system, see "Punched cards, their application to science and industry" by R. S. Casey and J. W. Perry, 1951.

Large volumes of data and extensive cross-classification require the use of punch cards and the mechanical equipment to use them. Manufacturers of these machines carry out surveys of the requirements of the statistical office and advise on the most efficient and economical equipment to meet the need.

A series of studies in data processing methods covering manual and punch card systems has been prepared jointly by the United Nations and the Food and Agriculture Organization. These studies explain in detail the different tools and their application. The following five studies have been completed:

1. Scope and principal methods of data processing
2. Planning, organizing and administering data processing services
3. The elements of planning and operating a punch-card installation
4. Manual methods and tools for data processing
5. Punch-card sorting.

14.4 Guiding principles in tabulation

We may trace each item of statistical information from its origin, viz., the event, through the informant, the enumerator, to the agency which should process the data, analyse and publish information either as routine tables or as reports. At this stage the guiding consideration should be to process, analyse and present the data so as to meet the needs of the various users, who would wish to be assured that the data were collected and handled with care and supplied promptly. The needs of the various users can be sought through the National Committee on Vital and Health Statistics.

One should bear in mind that a large part of the total cost of vital and health statistics collection goes usually in the long series of data-collecting operations such as enumerating, reporting, transcribing, editing, coding, punching, etc., all culminating in the preparation of the data for tabulation. There would be no satisfactory return from this investment unless the information were fully exploited by being made available in usable statistical tables and properly presented periodically to the consumers.

14.4.1 *Check on completeness of reporting*

No final tabulation should be undertaken unless reports have been received from every single constituent area and the reports are complete in all essentials. Any divergence from total coverage must be noted so that the

user is kept informed of the limitations of the data and also to establish a proper population basis for the calculation of rates. If it is found that figures of a predetermined quality cannot be achieved, the report may be divided into one or more parts, dealing separately with population groups for which statistical reports are good, and those from where statistics received are not of such high quality and are known to be deficient. For instance, areas in which the cause of death is certified by the medical practitioner could be separated from those where it is not so recorded. Figures collected for areas served by local health centres could be kept apart from other areas. In the United States the establishment of registration areas to include figures for only those States which attained at least 90% completeness helped to achieve accuracy. While the practice of separate tabulations by such groups is to be encouraged, efforts should be made to achieve complete coverage because some bias can creep into data limited to special tabulation areas. In USA the States originally included in the registration area were those with not only better registration, but also with lower infant mortality and birth rates. As other States were added from time to time to the registration area, States with higher infant mortality were included, and the rates changed because of the altered composition of the population.

14.4.2 *Detailed tabulations*

In undertaking tabulations the period of time covered should first be determined. This is usually the calendar year or month during which the events occurred. If, because of interest in seasonal variation of disease, it is considered more meaningful to have tabulations related to some other period as, for instance, the year ending 31 March, then provision should also be made for the figure for the calendar year to be derived.

The interest of the users lies in having the figures tabulated by the date of occurrence of the event and not according to when the event was later actually reported or registered. Some events occurring late in the year may fail to be registered until a few months into the following year. Tabulation cannot start, therefore, until one is reasonably certain that the bulk of the reports are received. The point at which one closes the books, so to speak, and begins tabulation, is known as the 'cut-off' date — the date after which it is no longer possible to add belated occurrences. One should try to ensure that the data received up to the cut-off date are revised and as complete as possible.

14.4.3 *Geographic classification*

One fundamental question is: "Where did the events occur, and to whom?" Two very different concepts are involved. We may be thinking either:

(a) of events which happened in a specified area among both resident and non-resident populations, or

(b) of events occurring in the population usually residing in a geographic area.

Obviously for the country as a whole these two groups of persons and events may be identical except for persons out of the country or foreigners residing within the country. But as soon as we go below the national level the problem of resident allocation assumes importance. Shall births which occurred in the hospital in the capital city be credited to that city, even though the mothers may have come from outside to avail themselves of the modern facilities in the hospital? Shall these births be counted towards the birth rate of this urban area? Shall deaths from tuberculosis in a sanatorium be credited to the city and province in which that sanatorium is located, even though people from all over the country go there for treatment? Shall the tuberculosis death rate be forced to a high level in this area, when most of the sufferers do not really live there?

Births are usually counted in the place where the mother of the child resides, and deaths where the deceased lived. But there may be tabulations which would have more meaning by place of occurrence, as for example, road accidents indicating some hazard of the area where they occurred, or typhoid deaths pointing the way to the source of infection. But in general, for public health purposes, place-of-residence tabulations are made.

Whichever definition of the term "residence" is used for the population census, it must also be used in recording vital and health statistics, so that the numerator of the rates matches the denominator.

14.4.4 *Tabulation for geographical areas*

After the events have been adjusted for residence, tabulations are made by major civil divisions, cities and so on. In particular, attempts are made to tabulate information separately for urban, semi-urban or rural areas. What we are really trying to do in tabulating by urban or rural areas is to introduce some sort of index of living conditions or environment, assuming that there is something different about these conditions affecting disease, mortality, natality, etc., occurring in an urban environment from those in the rural environment. In the absence of an internationally agreed definition of the terms urban and rural, the United Nations has suggested that the population should be classified according to the size of the cluster or agglomeration in which they live (see Section 3.11.11).

14.4.5 *Effect of definitions of events*

Each event tabulated must be exclusive of all other events. For example, stillbirth tabulations must exclude all live births and deaths. Likewise, live birth tabulation must refer only to live births and must not include stillbirths or foetal deaths.

14.4.6 *Classification by age, sex, etc.*

For developing more detailed plans of tabulation, e.g. of such characteristics as age, sex, occupation, etc., an easy approach is to see what international agencies or national regulations require. For instance, how should the

figures be tabulated so that the data can be included in the various detailed tables of the United Nations Demographic Yearbook or the WHO Annual Epidemiological and Vital Statistics? Further, it is necessary to adhere to the requirements laid down in the WHO Regulations No. 1 (see Appendix IIIa). An appropriate age classification and shorter lists for tabulation have been suggested. Special tabulations are recommended for deaths occurring under one year of age. Further recommendations are contained in the United Nations "Principles for a Vital Statistics System".

14.4.7 *Tabulation by leading cause of death*

In order to bring into relief the major public health problems or more specifically the important causes of death, a condensed table may be required in which the diseases or groups of diseases are ranked in order of magnitude. The way in which the specific diseases are grouped in the condensed list largely determines which groups emerge as the leading causes. International agreement has not been reached on the most suitable grouping to be adopted for this purpose. In 1951 a list of 64 causes was recommended for the United States by the Public Health Conference on Records and Statistics. In 1956 Curiel[1] suggested an adaptation of International List B (see Appendix IV) by combining certain B categories with broader groups and leaving out the ill-defined groups, so that 42 categories are used instead of the original 50. A similar list of 41 categories based on List B has been used in a WHO study of the leading causes of death in selected countries[2]. However, the B list cannot be adapted for ranking causes of deaths among infants. Pending an internationally agreed list for this purpose, a suitable list could be devised to suit local or national needs, provided the constituents of each cause group are clearly specified in terms of the detailed list of code numbers.

The importance of individual diseases cannot of course be judged merely from mortality figures because certain diseases causing no deaths or low fatality may create serious social and economic problems. In the case of mortality also a study of productive years lost would be more illuminating. Methods for computing the years lost have been elaborated among others by Dickinson and Walker[3], Martin[4], Haenszel[5], and Logan and Benjamin[6]. A discussion of the methods is beyond the scope of this book.

[1] Principal causes of death needed for a uniform method of selection for international purposes. D. Curiel, Boletin de la Oficina Sanitaria Panamericana, 1956. Vol. XL, No. 3, p. 203.

[2] WHO Epidemiological & Vital Statistics Report 1959, Nos. 5-6.

[3] What is the leading cause of death? Two new measures, by F. G. Dickinson and E. L. Walker. Amer. Med. Assoc. Bureau of Medical Economics Research Bulletin. 1948. 64.

[4] Life table mortality as a measure of hygiene, by W. J. Martin. Medical Officer, October 1951, 151-153.

[5] A standardized rate for mortality defined in units of lost years of life, by W. Haenszel, American Journ. Public Health, 1950, No. 4, Vol. 40, pp. 17-26.

[6] Loss of expected years of life—a perspective view of changes between 1848-72 and 1952, by W. P. D. Logan and B. Benjamin. Monthly Bulletin Ministry of Health, 1953, Vol. 12, pp. 244-52.

14.4.8 *Tabulation versus presentation*

A distinction should be drawn between tabulation and presentation or publication, because with modern tabulating machine equipment, many tables may be produced which cannot be conveniently issued in a single publication. This does not mean that every conceivable tabulation or cross tabulation should be made indiscriminately. Nevertheless, tabulation should not be unnecessarily restricted and should cover cases for which there is a current need or a real potential use in terms of maintaining a continuous series in greater detail than can be readily published routinely. It may be desirable to publish such figures in summary form every five or ten years or to present averages which may have more meaning than data for a single year.

14.5 Construction of tables

Good tabular presentation is an art and needs the collaboration of both statistician and printer. It is difficult to cover this topic in brief. For a good exposition of table construction and design reference should be made to "Manual of tabular presentation of the United States Bureau of the Census" by Bruce L. Jenkinson, 1949, US Government Printing Office, Washington.

Tabular forms used in standard national and international publications could be consulted when tables are prepared to present similar data. The few hints given below are not intended to replace more exhaustive studies of the Manual of Tabular Presentation or practice in the art of table construction.

14.5.1 *Points for special consideration in connexion with tabulation*

Tables pertaining to one particular study should be presented in the logical sequence of the study and serially numbered.

Tables should have suitable self-contained headings with a clear and precise description of the contents with descriptive sub-headings for respective rows and columns. Headings should make it perfectly clear whether the figures are new admissions, or all treatments, or examinations, or persons examined; incidence (such as new cases *per month*) or prevalence (inventory at a specific time).

The conventional sequence in table heading is: subject, distribution, place, time.

As far as practicable, tables should be simple and not complicated by large size. Large tables should be split up into smaller and separate sections and if necessary summary tables should be provided.

The source of information should be stated in the heading or in a footnote.

In calculated figures, avoid unnecessarily large numbers of decimals, especially when the reliability of the basic data is questionable.

The use of different sized letters for headings and columns, heavy type for totals, italics for rates and percentages, light and heavy rulings, some space after every 3rd, 5th or 10th row of figures, helps in making the table clear.

The base for rates or percentages should be clearly indicated. Words like

"rate" and "per cent" alone are not always definite descriptions; sometimes it is necessary to indicate whether one is taking percentages "horizontally" or "vertically".

In big tables, columns should be serially numbered to facilitate reference in the text.

If a portion of the data has to be excluded, state the reason for exclusion in a footnote.

Use the general reader's language and avoid unnecessary technical jargon or professional slang.

Avoid all unusual abbreviations or define them clearly.

Use footnotes to define all unusual terms and abbreviations; to show sources of data and inconsistencies, and to avoid cumbersome titles or column headings.

Avoid using established terms under a new definition even if approved by a limited professional group.

Make logical sequences, e.g., geographic sequence is frequently better than alphabetic; death rates in small tables are frequently better given in order of magnitude rather than by cause of death code numbers; time sequences are frequently helpful. Select the sequence most convenient to the reader; or one which will bring out a desired inference.

Bring together data which the reader may want to associate or contrast. Normally the reader will want to compare rates rather than the components of the rates. Occasionally, a given arrangement is most convenient for the computor; the finished product, however, should be organized for the convenience of the ultimate user of the tables.

The word "total" by itself is frequently vague. It is usually advisable to use specific names for totals and sub-totals, especially in complex tables; e.g., all cases, all positives, all specimens, all persons, all males, etc.

Let each table stand on its own feet; do not ask the reader to guess or search the text for the meaning of the table.

14.5.2 *Manual of procedures for tabulation*

Each statistical office should maintain a manual of instructions or procedures for the tabulation of the routine data giving a clear indication of the responsibility of various individuals for checking, coding, punching, sorting and tabulating by machines, and preparation of final tables and their checking.

14.6 Analysis and presentation of statistics

In presenting analyses of data, the user should be informed of their sources, modes of collection and compilation and the associated defects or limitations of statistical information. Consideration should also be given to the methods used for classification and the estimation of population figures to serve as a base in the computation of rates. Problems arising from differences in the population composition of different areas and the possibility of differences in the definitions used, should be mentioned.

In regard to incompleteness and unreliability of data, it has already been suggested that figures could be studied separately for areas producing them with varying degrees of accuracy. The need for studying figures separately for urban areas with concentration of medical practitioners is thus brought out. The problem of delayed registration, as well as of resident allocation, has also been remarked.

14.6.1 *Calculation of rates and indices*

One of the most important problems in the computation of health statistics rates or indices is to estimate reliable population figures corresponding to the health statistics in question, (see Section 15.1).

14.6.2 *Comparability of cause of death statistics due to revision of statistical classification*

Comparability of cause of death may not be a particular problem if the same classification list is used. However, since these lists have been revised from time to time, the data have also been classified by one revision for one period and by a different classification for another. The gap produced by any change in classification procedure has therefore to be bridged. One way is to make a judicious grouping of causes so that the effects of the procedural changes are eliminated. The disadvantage of this method is that specificity of certain causes of death may be sacrificed. A more satisfactory method is to determine the degree of comparability of the two revision periods by classifying the same data by the classification procedures used in the two periods. The results could be utilized to compute comparability ratios to adjust one set of data in order to make them comparable with the other.

14.6.3 *Effect of confidentiality of medical certification and diagnosis*

In some countries, in order to prevent public disclosure of cause of death, legal provision is made to keep the death certificate confidential so that medical information that may be prejudicial to the memory of the deceased or to his survivors is not disclosed. Even without such laws, professional secrecy operates to a certain extent in the reporting of specific causes like venereal diseases, alcoholism, tuberculosis and cancer. The degree of confidentiality may vary.

The accuracy of cause-of-death statistics also depends on the availability of diagnostic aids (hospital diagnosis, autopsy, laboratory findings), and the diagnostic acumen of the medical practitioners. A rough index of the reliability of statistics on cause of death may be obtained from the proportion of deaths attributed to senility and ill-defined and unknown causes. Many deaths so classified may not reflect on the physician's diagnostic ability because the death may have occurred before the practitioner had an opportunity to examine the case sufficiently to arrive at a definite diagnosis.

14.7 Statistical report

Among other items of information, the text of the statistical report should

explain how the data were obtained, e.g., what method of collection was used — was it a house-to-house survey, a census, registration or notification of information? The basic definitions of the terms used should be stated, (e.g., how was age defined? Who diagnosed the disease, or who certified the cause of death?).

Another section of the report should set out the limitations of the data, in coverage, completeness and quality; what qualifications need to be kept in mind; and how far was the notification of disease or registration complete?

Finally, a section incorporating the main findings or conclusions drawn should appear. Reports may be monthly, annual or periodical, but there should be a plan for prompt and regular publication. A deadline should be fixed and strictly adhered to because there is frequent criticism of the belated appearance of most of the statistical reports.

In most health statistical offices it is customary to publish a monthly report of totals, which is obtained quickly and serves as a guide to the trend of the birth and death rates and as a means of estimating the probable annual figures. Figures of notifiable disease are published at weekly intervals.

The annual report contains historical series and specific cross-tabulations required to meet the users' needs, plus all basic geographic tabulations. It is necessary for the statistical office to review frequently the needs of the various users of the data and to improve the tabulations accordingly. Some offices have found it expedient on the basis of an analysis of past requests received for data, to prepare a separate brief publication to meet these requests. See, for example, the United States "Summary of health and vital statistics — a compendium of the highlights of statistics most commonly used for answering enquiries".

14.8 Annual health report

Whether the annual health report is prepared for a local health unit, city, county, state or country, the statistical data collected from various sources form an important part and help to achieve objectivity of approach. It is therefore necessary for the health statistician to understand the role he should play in the preparation of these reports.

Among the various needs, the statistical content of the annual health reports serves to assess the state of health during the period based on relevant information about mortality and morbidity; to compare with the past and with other areas; to maintain a record of the health services, co-ordinate information from constituent areas, inform public in health matters, provide a basis for comparison and indicate the progress achieved and any new trends.

However limited the health services and facilities for collecting and recording data, the statistical part of the report is necessary both to support the narrative and to record the data for future use in a readable form, illuminated by illustrative material like maps, charts and diagrams. In many cases the blame for delay is laid on the statistician for not providing the statistical matter in time. Hence the necessity for fixing a time-table for completion of statistical tabulation and analysis.

CHAPTER 15

Analysis of Demographic Data

15.1 Introduction

Basic health statistics consist mostly of counts of the occurrence of different events such as birth, death, marriage, stillbirth, etc. For studying whether public health services in any place are adequate, a knowledge of such counts is of value. For instance, the information is used to estimate the requirements of doctors, hospitals, maternity centres, nurses, midwives, or drugs. But if our interest is to compare health conditions of one place with another, then more counts of cases or deaths in the two places is not sufficient, because the larger the population, the larger will be the number of events. It is necessary, therefore, to know the size of the population of each place and to make allowance for it. As an example, to compare the importance of an illness in a population group, it is not sufficient to know merely the number of those who have the illness — we should also ascertain the number of those who run the risk of having it.

The simplest method of making such comparisons among groups of people is to compute relative figures, rates or ratios. A rate is obtained by a process of division, in which the numerator counts the number of times an event has occurred in a specified time period, and the denominator enumerates the total number of individuals exposed to the risk of that event in the same period. The ratio of these two numbers is generally multiplied by 100 or 1000 or 10,000, so as to express the result as a number of convenient magnitude, i.e., not to leave it as a decimal fraction beginning with zeros.

In spite of the frequent lack of significance of the last digit, rates are customarily published to one decimal place. Rates based on very few events are subject to large variation due to chance; hence those based on less than 20 events in the numerator may be enclosed in brackets or published in italics, to signify lower degree of their precision. No standard definition of the terms "rate" or "ratio" applicable to general health work has been adopted. What is necessary is that the numerator of the rate, i.e. the number of events, should be defined according to (a) the character of the event in question, (b) the geographical area to which the event belongs, and (c) the time period within which it occurred. The denominator, i.e. the population to which the events are related in computing a rate, should correspond to the numerator in all the three respects. But the population is not recorded continuously. As mentioned in chapter 3, it is counted only at the time of the census. It has therefore to be estimated according to need either for the beginning or the middle of the year, or at other intervals

(Section 15.2), depending upon the rates for which its estimate is required.

The principle of correspondence between the events and the population base requires that both the series of data be defined, classified and tabulated in exactly the same manner (see Chapter 13). Events should be tabulated: (a) by date of occurrence rather than by date of registration; and (b) by place of residence rather than by place of occurrence. If complete correspondence between the two elements of a rate cannot be achieved, the divergences should be indicated. Ignorance or disregard of lack of correspondence can result in meaningless or misleading rates.

15.2 Estimation of intercensal or postcensal population

Estimates of population are required for the years falling between two census dates (intercensal estimates) or following the last census (postcensal estimates). The problem here is to determine the population figure which best "corresponds" to the vital events. Most annual rates are computed by using the population estimate referring to 1 July (mid-year population). Sometimes, as the result of a new census or some other fresh information, there is an abrupt change of considerable magnitude in the population estimates used for calculating vital rates. When such discontinuity occurs, reference to the change should be indicated, separating the years before and after the change.

A number of methods have been suggested for making population estimates of which the three most commonly used are described below. A full discussion of the methods of estimating population appears in three Manuals "Methods of Estimating Population" published by the United Nations.[1]

15.2.1 *The method of natural increase*

This method can be applied for an area where the registration of births and deaths is satisfactory and, further, if satisfactory statistics of migration are also available. The method consists of adding to the last census population the excess of births over deaths and the balance of immigration over emigration, during the period from the last census to the time when the estimate is to be made. The method does not provide estimates of the population for any future date. In countries where vital statistics and data on migration are of a high level of accuracy, the method provides good estimates.

Example: From the following figures of the census population, births, deaths, emigrants and immigrants, estimate the mid-year population of Iceland for the year 1950.

Mid-year population of Iceland in 1947 = 134,000

Vital statistics of Iceland during 1947-1950:

[1] Methods of estimating population: Manual I: Methods of estimating total population for current dates. ST/SOA/Series A/10.

Methods of estimating population: Manual II: Methods of appraisal of quality of basic data for population estimates. ST/SOA/Series A/23.

Methods of estimating population: Manual III: Methods for population projections by sex and age. ST/SOA/Series A/25.

Year	Births	Deaths	Immigrants	Emigrants
1947	3,703	1,162	8,220	8,433
1948	3,813	1,114	9,135	9,895
1949	3,854	1,106	11,688	11,606
1950	4,037	1,127	8,695	9,542

We estimate the mid-year population of Iceland for 1950, by first calculating the net increase of each year as follows:

Year	Excess of births over deaths	Excess of immigration over emigration	Annual net increase
1947	2,541	—213	2,328
1948	2,699	—760	1,939
1949	2,748	82	2,830
1950	2,910	—847	2,063

Since the population for the year 1947 is known at the middle of the year, we calculate the net increase in the second half of 1947 by taking 1/2 of 2,328, i.e., 1,164. To this we add the annual increase in 1948 and 1949, i.e., 1,939 and 2,830 respectively. The addition of these three figures to the 1947 mid-year population gives the population estimate at the end of 1949. Since we want the estimate at the middle of 1950, we add to this population half the net increase in 1950. The mid-year population of 1950 is thus 134,000 + 1,164 + 1,939 + 2,830 + 1,032 = 140,965.

15.2.2 *The arithmetic progression, or "A.P." method*

In this method it is assumed that the population increases or decreases by a constant figure from year to year between any two census years. The difference between the population figures of the two censuses gives the total increase of the population in 10 years. Dividing the number by 10 (the period between two censuses) we obtain the growth for one year. Assuming that this annual change occurs uniformly, we calculate the growth of the population from the last census to the time when the estimate is required.

Example: Populations of India enumerated at 1 March 1941 and 1 March 1951 were 314,830,190 and 356,879,394 respectively.

$$\text{Increase in 10 years} = 356,879,394 - 314,830,190 = 42,049,204$$

$$\text{Average increase in one year} = \frac{42,049,204}{10} = 4,204,920$$

To calculate the population of India in the middle of the year 1941, we should note that since the census of 1941 was taken on 1 March 1941, we should add the increase for only four months of the year.

$$\text{Mid-year population for 1941} = 314,830,190 + \frac{4}{12}(4,204,920) = 316,231,830$$

To calculate mid-year population for 1942, we add to the above figure an average increase for one year.

The A.P. method can also be used to find the population for a year after the last census. Such population estimates are called the postcensal mid-year estimates. The postcensal mid-year estimate for 1954 would be found by adding to the 1941 census figure the increase in four months and 13 years.

$$\text{Thus, mid-year 1954 estimate} = 314{,}830{,}190 + \frac{4}{12}(4{,}204{,}920, + 13\,(4{,}204{,}920)$$
$$= 370{,}895{,}790$$

15.2.3 *The geometric progression or "G.P." method*

In the A.P. method described above we have assumed that the increase in population is constant throughout the period. An alternative assumption can be made that it is the percentage rate of growth that remains constant. If a population has grown from one million to three millions in a year, then in the next year, the population would grow to nine million, according to constant rate or the geometric law of growth. On the other hand, according to the arithmetic progression increase, the population at the end of the second year would be only five million instead of nine million.

If P_1 and P_2 are the populations at the two census periods, and r is the annual rate at which the population is growing in geometric progression, then P_1 grows to (P_1+P_1r) or to $P_1\,(1+r)$ at the end of one year. It grows to $P_1\,(1+r)^2$ at the end of two years, and so on to $P_1\,(1+r)^{10}$ at the end of ten years. From this relationship, as exemplified below, we can calculate the numerical value of the rate of growth and then estimate the population at any time.

Example: From the data given in the previous example to estimate the mid-year population of India for 1943 and 1954 by the G.P. method.

If r denotes the rate at which population increases in geometric progression per year, then:

Population on 1 March 1951 = Population on 1 March 1941 $\times\ (1 + r)^{10}$ or $356{,}879{,}394 = 314{,}830{,}190 \times (1 + r)^{10}$

Taking logarithms; $\log 356{,}879{,}394 = \log 314{,}830{,}190 + 10 \log (1 + r)$

$$\text{Therefore, } \log (1 + r) = \frac{\log 356{,}879{,}394 - \log 314{,}830{,}190}{10}$$
$$= 0.0054445$$

Mid-year population in 1943 $= 314{,}830{,}190\ (1 + r)^{2+1/3}$

$$\text{Log mid-year population in 1943} = \log 314{,}830{,}190 + (2 + 1/3) \times \log(1+r)$$
$$= 8.4980761 + (2 + 1/3) \times 0.0054445$$
$$= 8.5107799$$

Taking antilogarithms, we get the mid-year population of 1943 as 324,180,000.

Similarly, the mid-year estimated population for 1954 $= 314{,}830{,}190 \times (1 + r)^{13+1/3}$.

Taking logarithms:

$$\text{Log of mid-year population of 1954} = \log 314{,}830{,}190 + (13+1/3) \times \log (1+r)$$
$$= 8.5706694$$

Taking antilogarithms, the estimated mid-year population of 1954 = 372,110,000.

It should be noted that the G.P. method gives a higher estimate than the A.P. method for the postcensal period, but a smaller estimate for the intercensal period.

15.3 Definitions of terms used in demographic statistics

A definition of the term used to describe an event is necessary for making valid comparisons of the indices derived from it. For immediate reference, the definitions of some of the terms commonly used are given below. Wherever available the definition set out is the one recommended by the United Nations or the World Health Organization.[1] Failing an internationally agreed definition, that put forward by National Committees on Vital and Health Statistics or used in national publications is reproduced.

Live birth

"Live birth" is the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy, which, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered "live-born".

This definition was recommended by the WHO Expert Committee on Health Statistics and adopted by the Third World Health Assembly.

All live-born infants should be registered and counted as such, irrespective of the period of gestation, or whether alive or dead at the time of registration, and if they die at any time following birth they should also be registered and counted as deaths.

Death

"Death" is the permanent disappearance of all evidence of life at any time after live birth has taken place (post-natal cessation of vital functions without capability of resuscitation). This definition, therefore, excludes foetal deaths.

Foetal death

"Foetal death" is death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the foetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles.

This definition was recommended by the WHO Expert Committee on Health Statistics and adopted by the Third World Health Assembly.

[1] The definitions are derived from the following sources:

Multilingual Demographic Dictionary. United Nations Population Studies No. 29 (document ST/SOA/SER. A/29, 1958).

Handbook of Vital Statistics Methods. United Nations Studies in Methods, Series F, No. 7, 1954. New York.

Expert Committee on Health Statistics. World Health Organization Technical Report Series Nos. 25, 133, Geneva.

International Classification of Diseases, Vol. 1, 1957. World Health Organization, Geneva.

Abortion

"Abortion", as applied to a *product of conception*, has not been defined by WHO, and the term should be retained only if essential for internal use within a country. The term can, however, be used to describe a specific type of delivery, in accordance with the International Classification of Diseases, 1957 (code numbers 650-652).

Stillbirth

"Stillbirth" is defined as synonymous with late foetal death (Group III), that is, a foetal death occurring after twenty-eight completed weeks of gestation or over. Countries which prefer to continue to use the term "stillbirth" in statistical publications instead of the term "foetal death" should in such publications, define stillbirth in terms of the international definition.

Immaturity (prematurity)

In the International Classification of Diseases the definition used in classifying diseases and causes of death in early infancy is: ". . . an immature infant is a live-born infant with a birth weight of $5^1/_2$ lbs (2,500 grams) or less, or specified as immature. In some countries, however, this criterion will not be applicable. If weight is not specified, a live-born infant with a period of gestation of less than 37 weeks or specified as "premature" may be considered as the equivalent of an immature infant for purposes of this classification."

An infant with a birth weight of 2,500 grams or less, that shows any signs of life, in accordance with the definition given earlier, is classified as an immature live birth.

Some countries may consider it desirable to classify infants at birth by birth weight criterion lower than that given in the international definition. When this is done, the numbers of infants above the national birth weight criterion and up to 2,500 grams should also be given.

Age

See Section 13.5 for definition.

Infant deaths

Deaths occurring under one year of age.

Neonatal deaths

Deaths occurring under 28 days of age.

Perinatal deaths

See Chapter 16.

Maternal deaths

Deaths which are classified under the code numbers 640-648 and 650-689) (deliveries and complications of pregnancy, childbirth, and the puerperium, of the International Classification of Diseases, 1957.

Cause of death See Section 13.2.

Marriage

Marriage is the legal union of persons of opposite sex. The legality of the union may be established by civil, religious, or other means as recognized by the laws of each country; and irrespective of the type of marriage, each should be reported for vital statistics purposes.

Divorce

Divorce is a final dissolution of a marriage, that is, the separation of husband and wife by a judicial decree which confers on the parties the right to civil and/or religious remarriage, according to the laws of each country.

Occupation and industry

See Chapter 13.

15.4 Basic formulae for the calculation of indices

Certain procedures and concepts underlying the computation of various demographic and health indices are described below. Numerical examples of their use are given in chapters 16, 17, and 18. For a detailed discussion of the procedures and concepts see chapters I to V of Vital Statistics Rates in the United States by Forrest E. Linder and Robert D. Grove as well as chapter XIII of the United Nations Handbook of Vital Statistics Methods.

Crude rates

A crude rate, sometimes known also as general rate, global rate, total rate, or gross rate, is computed with respect to the total population, without regard to any specific characteristics of that population. Such rates measure the proportion prevailing between the number of events under consideration and the total population. The general formula for a crude rate, irrespective of the vital event to which it refers, is:

$$\text{Crude rate per thousand}^{1} = \frac{\text{Number of events which occurred among the population of a given geographic area during a given period}}{\text{Mid-period total population of the given geographic area during the same period}} \times 1000$$

Specific rate

Rates defined in terms of one or more characteristics of the population are known as specific rates. Any characteristic of the population may be the basis for a specific rate. Those found most useful and feasible are age, sex, birth order, occupation, marital status, etc.

$$\text{Specific rate per thousand} = \frac{\text{Number of events which occurred among a specific group of the population of a given geographic area during a given period}}{\text{Mid-period population of the specified group in the given geographic area during the same period}} \times 1000$$

[1] The term per mille is sometimes used in place of per thousand.

The specific rate is characterized by its reference to only one special segment of the population.

Annual rate

Although a crude rate or a specific rate may be computed for any period of time, it is a general rule to express it on an annual basis. An annual crude rate is obtained when the term "period" in the numerator and denominator of the above definition of the crude rate is replaced by the term "year" — preferably "calendar year". The same substitution in the definition of the specific rate defines the annual specific rate.

Should the time period be different from one year, it is customary, in order to facilitate comparison, to adjust the rates to an annual basis. Adjustment is achieved by multiplying the rate by an appropriate factor obtained by dividing the year by the period in question.

Quinquennial rate

When long-term trends are studied, it is convenient to calculate rates for five-yearly periods. If a quinquennial rate is required, the total events that occurred in a five-year period should be divided by five, to make the rate comparable with the annual rate. The general formula is:

$$\text{Quinquennial rate} = \frac{\text{Number of vital events which occurred among the population of a given geographic area during the period of five years}}{\text{Population estimated at the middle of the five years}} \times {}^1/_5 \times 1000$$

Decennial rate

$$\text{Decennial rate} = \frac{\text{Number of vital events which occurred among the population of a given geographic area during the period of ten years}}{\text{Population estimated at the middle of the ten years}} \times {}^1/_{10} \times 1000$$

Weekly rate

In the study of seasonal variations of diseases, rates are calculated for periods shorter than a calendar year. To express it on an annual basis, the weekly rate is multiplied by 52. The formula is:

$$\text{Weekly rate} = \frac{\text{Number of vital events occurring in one week}}{\text{Total mid-year estimated population}} \times 52 \times 1000$$

The rate is not sensibly affected by the use of the estimated mid-year population in the denominator, as generally variations in population size are

relatively small in the course of one year. Furthermore, as a rule only one annual estimate of the total population, i.e. the mid-year population, is published.

Monthly rate

Similarly, monthly rates are calculated by using an adjustment factor equal to 12 or more exactly, using the fraction,

$$\frac{365}{\text{number of days in the month considered}}$$

Quarterly rate

For computation of a quarterly rate, the adjustment factor is 4.

Half-yearly rate

Use is made of an adjustment factor of 2 for a half-yearly rate.

CHAPTER 16

Mortality and Fertility Rates[1]

16.1 Crude death rate

To measure the decrease of population due to death the rate commonly used is the crude death rate described below.

As an example, consider the figures of two islands, Ceylon and Cyprus. In 1950 there were 95,142 deaths in Ceylon and 3,959 deaths in Cyprus. Does it mean that the mortality level in Ceylon was higher than in Cyprus in 1950? During 1949 there were 91,889 deaths in Ceylon — fewer than in 1950. Does it mean that in 1950 the mortality conditions of Ceylon were worse than in 1949?

The method of answering the above questions is to work out what would have been the number of deaths in the two places if they were both of the same population size. The population of Ceylon in 1949 and in 1950 was 7,321,000 and 7,544,000 respectively and that of Cyprus in 1950 484,000. We therefore ask: "How many deaths would have occurred in Ceylon and Cyprus if in both places the population had been the same, as for instance 1000 persons?" The number of deaths per one thousand of the population can be calculated by the simple proportion;

Number of deaths per 1000 of the population of Ceylon

$$= \frac{\text{Total deaths}}{\text{Total population}} \times 1000 = \frac{95{,}142}{7{,}544{,}000} \times 1000 = 12.6$$

In the same way the number of deaths occurring in 1000 of the population

$$\text{of Cyprus} = \frac{3{,}959 \times 1000}{484{,}000} = 8.2$$

This calculation shows that in Ceylon there was an average of 12.6 deaths in 1000 of its population, while in Cyprus only 8.2. These two figures, viz. 12.6 and 8.2 are the annual crude death rates of the two countries for 1950 per 1000 population. Adopting the same method, the crude death rate for Ceylon for 1949 is found to be:

$$\frac{91{,}889}{7{,}321{,}000} \times 1000 = 12.6$$

The rates for both the years are the same.

The formula for the crude death rate is:

[1] For fuller discussion see. Handbook of Vital Statistics Methods, UN/ST/STAT/SER. F. 7.

$$\text{Crude death rate} = \frac{\text{Number of deaths which occurred among the population of a given geographic area during a given year}}{\text{Mid-year total population of the given geographic area during the same year}} \times 1000$$

The crude death rate is perhaps the most widely used of any vital rate. This is because it is relatively easy to compute, requiring only total deaths and total population, and it has value as an index to numerous demographic and public health problems. Within broad limits, the crude death rate represents the probability of dying for persons in the population. As such, it can be interpreted in terms of public health since the rate of death is the first approximate measure of the health status of a population.[1]

Care is needed in the use of the crude death rate for inter-area comparisons. Mortality varies with age. The crude rate which masks all age differences may therefore be misleading, if the age-sex structures of the populations being compared are not similar. Populations composed of a high proportion of persons at the older ages, where mortality is higher, will naturally show a higher crude death rate than a "younger" population. Some deaths escape registration. The degree of under-registration of deaths also greatly influences the value of the rate.

The crude death rate is valid for comparisons for the same area from year to year, since changes in the composition of the population of an area occur rather slowly. If a long-term trend is studied the effect of population changes must be allowed for. Where it is known that the population distributions are approximately similar, or where the crude rate differences are large, as in many international comparisons, the crude rate has value as an index of mortality.

16.1.1 *Annual crude death rate*

When a crude death rate is calculated on an annual basis, the Calendar or Gregorian year (1 January — 31 December) is recommended as the most appropriate unit period for a number of reasons. Administrative activity is planned on a yearly basis and therefore reports compiled on the same basis need annual rates. Since several causes of death vary with the season, a rate computed on an annual basis includes the effect of all the seasons and therefore provides a comparable figure in so far as seasonal effects are concerned. In many countries, however, the national year begins with some other day. For international comparisons the United Nations recommend that such countries produce rates also for the Gregorian year.

A series of diagrams is presented in the book to show the use of the annual crude death rate. The decrease in this rate for New York City from 1850 to 1955 is shown in Fig. 16.1a. Annual crude death rates for various countries for the year 1955 are given in Fig. 16.1b. The decrease recorded in some of them over a number of years is shown by Fig. 16.1c. Figures of annual

[1] See: Report of Study Group on Measurement of Levels of Health. World Health Organization Technical Report Series No. 137, p. 12, 1957. Geneva.

TREND OF THE DEATH RATE IN NEW YORK CITY, 1800-1955

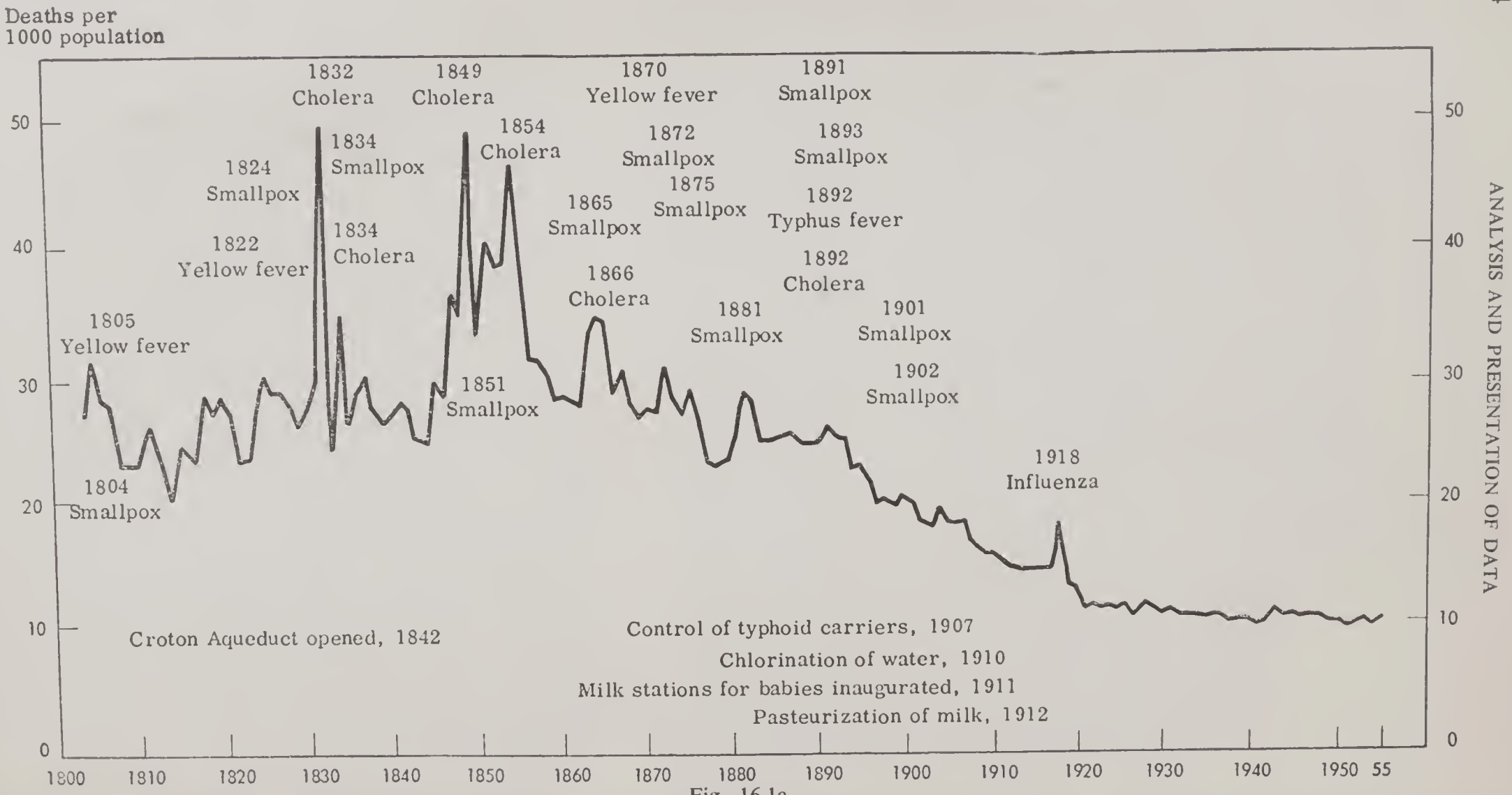
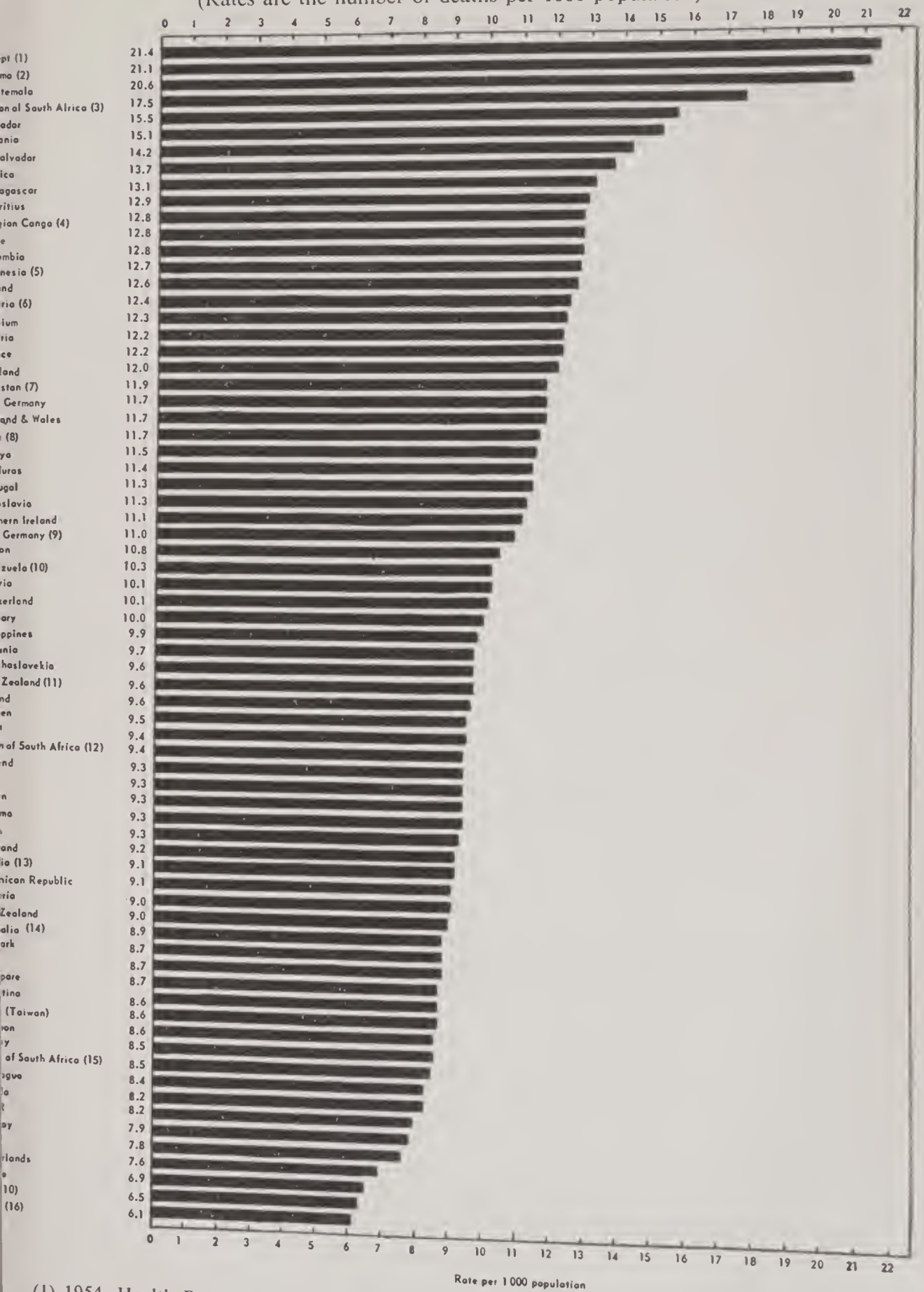


Fig. 16.1a

CRUDE DEATH RATE IN 71 COUNTRIES, 1955

(Rates are the number of deaths per 1000 population)

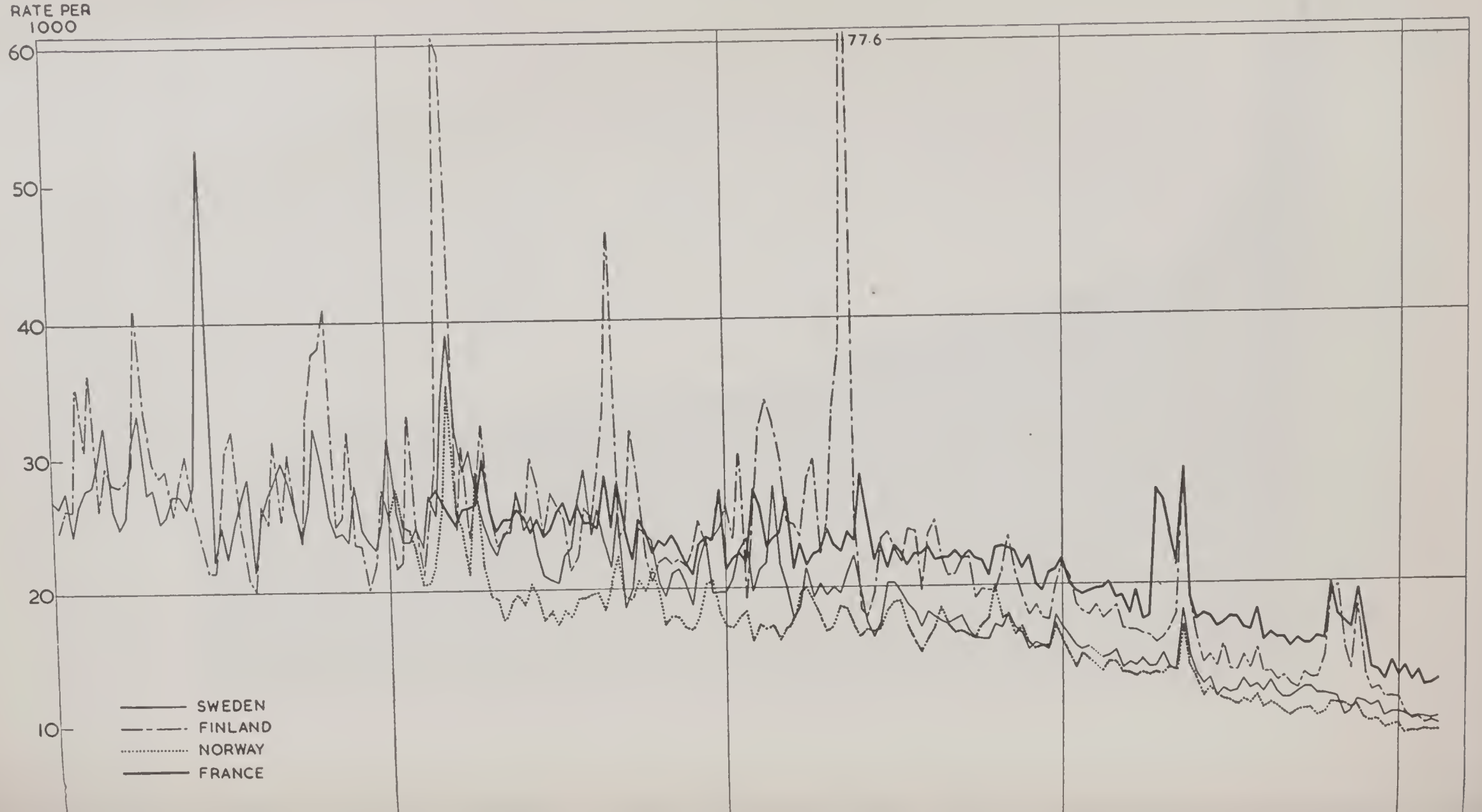


(1) 1954, Health Bureau; (2) 61 towns only; (3) Coloured population (mixed); (4) Indigenous population; (5) 91 Regencies in Java; (6) Moslem population; (7) 1951, Registration area, excluding live-born infants dying before registration of birth; (8) Registration area, excluding data for Bihar, Madhya Pradesh and Orissa; (9) Including the Saar; (10) Excluding Indian jungle population; (11) Maori population; (12) Asiatic population; (13) European population; (14) Excluding full-blooded aborigines; (15) White population; (16) Excluding Bedouin population in the Negev.

Fig. 16.1b

TREND OF THE ANNUAL CRUDE DEATH RATE IN CERTAIN COUNTRIES, 1750-1956

A. 1750-1956



B. 1800-1956

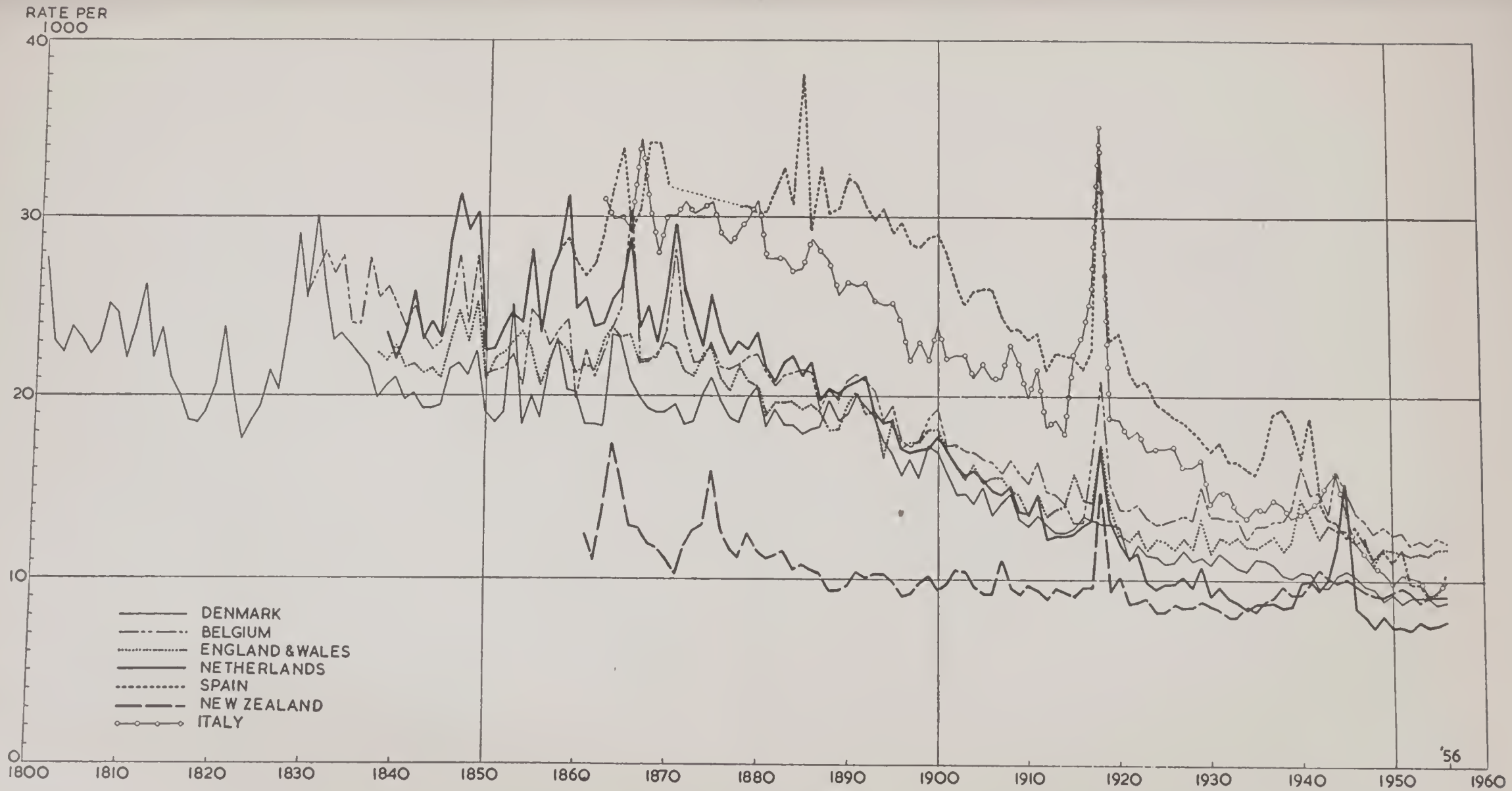
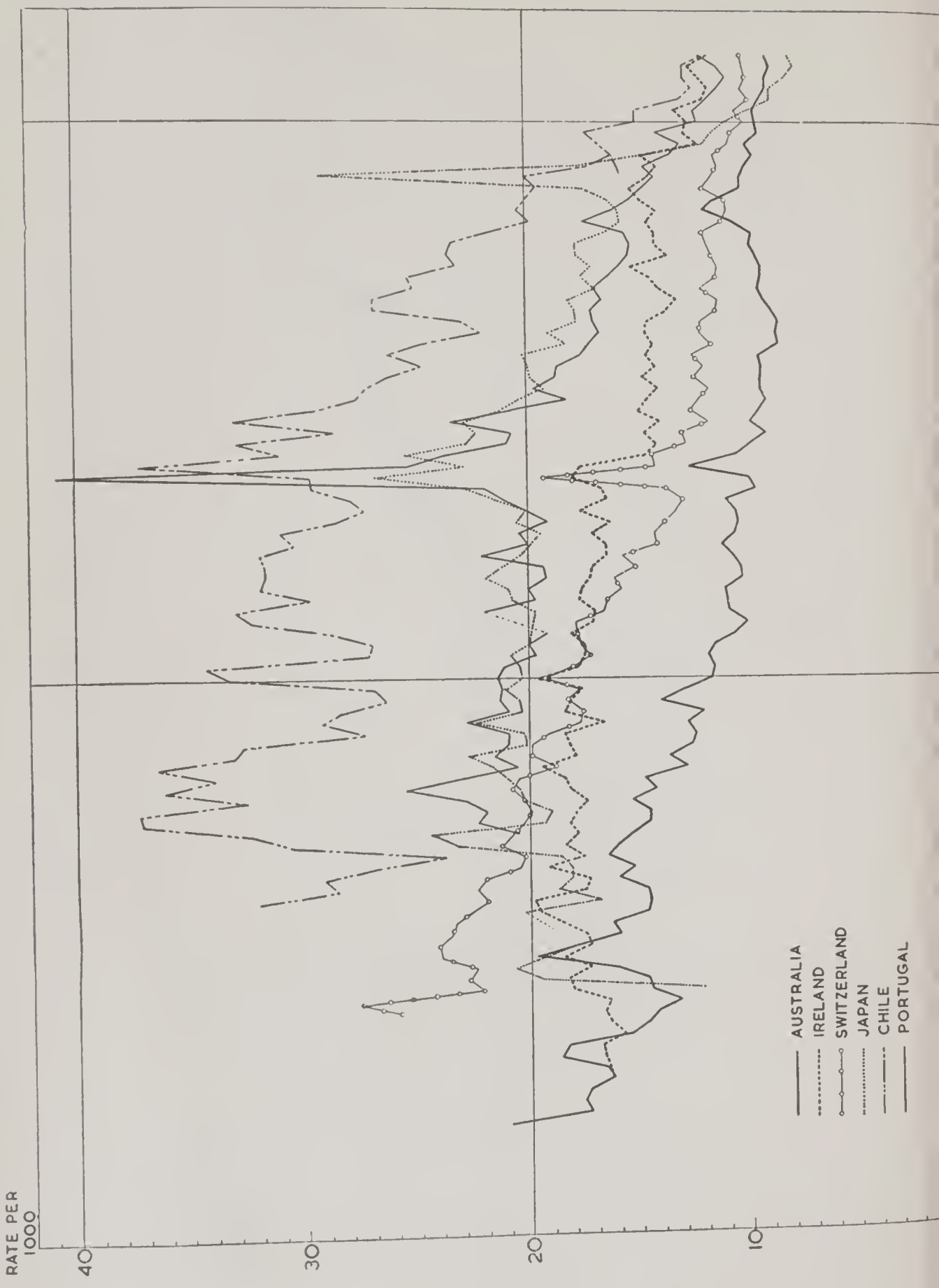


Fig. 16.1c (continued)

C. 1850-1956


RATE PER 1000
40
30
20
10
AUSTRALIA
IRELAND
SWITZERLAND
JAPAN
CHILE
PORTUGAL

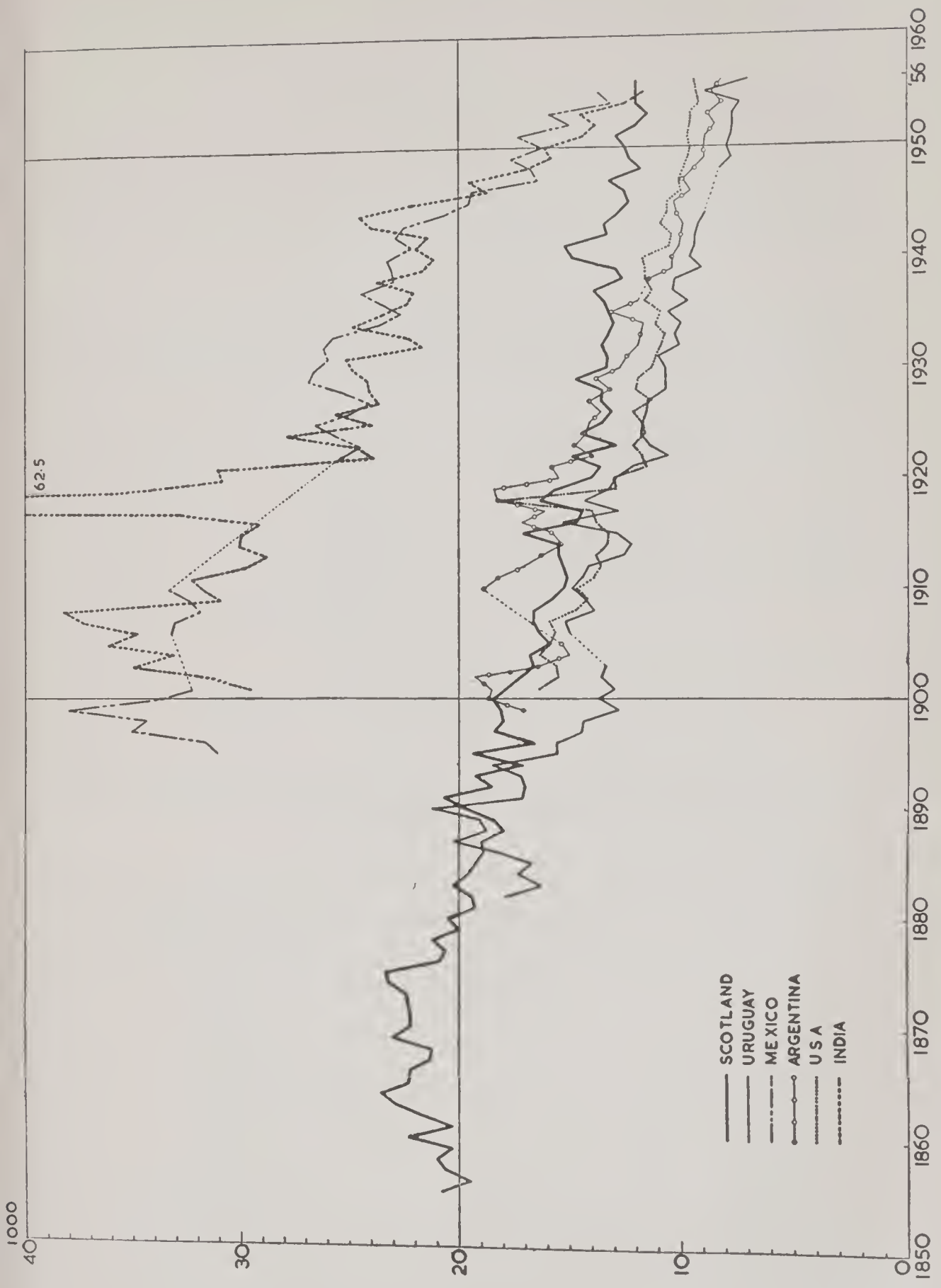

1000
40
30
20
10
0
1850
1860
1870
1880
1890
1900
1910
1920
1930
1940
1950
'56 1960
62·5
SCOTLAND
URUGUAY
MEXICO
ARGENTINA
U S A
INDIA

Fig. 16.1c

crude death rates for various countries from as far back a period as available, are given in Tables V to VII in the Appendix.

16.1.2 *Quinquennial or decennial crude death rates*

Death rates, as also several other rates, are sometimes calculated for periods other than one year. When long-term trends are studied it is advantageous to calculate rates for five-yearly periods or ten-yearly periods. The formulae for the calculation of these rates are given in Section 15.4. The following are examples of their calculations:

Quinquennial crude death rate: Population estimates and the annual number of deaths for Japan for five years 1946-1950 are given below. To calculate the annual crude death rate and the quinquennial death rate for Japan for 1946-50:

Year	Population estimated for mid-year	Number of deaths	Annual crude death rate per mille
1946	75,800,000	1,326,592	17.5
1947	78,100,000	1,138,238	14.6
1948	80,010,000	950,610	11.9
1949	81,780,000	945,444	11.6
1950	82,900,000	904,876	10.9
		Total 5,265,760	

Quinquennial death rate of Japan for the period 1946-50

$$= \frac{5{,}265{,}760 \times 1000}{80{,}010{,}000 \times 5} = 13.2 \text{ per mille}$$

Decennial death rate: From the data for Thailand for the period 1940-49, the decennial death rate is calculated below:

Estimated mid-year population and number of deaths in Thailand for the period 1940-49

Year	Population estimated for the mid-year	Number of deaths in the year
1940	15,296,000	265,360
1941	15,574,000	265,288
1942	15,857,000	257,084
1943	16,145,000	297,053
1944	16,439,000	289,540
1945	16,737,000	276,582
1946	17,041,000	259,066
1947	17,351,000	234,315
1948	17,666,000	189,968
1949	17,987,000	190,401

Population estimated for 1 January, 1945

$$= \frac{16{,}439{,}000 + 16{,}737{,}000}{2} = 16{,}588{,}000$$

Total deaths during 1940-49 = 2,524,657
Average number of deaths per year during 1940-49 = 252,466
Decennial death rate for Thailand for 1940-49

$$= \frac{252{,}466 \times 1000}{16{,}588{,}000} = 15.2$$

The denominator of the quinquennial death rate is the estimated population at the middle of the third year and that for the decennial death rate is the estimated population at the end of the fifth year.

16.1.3 *Crude death rates for fractions of a year*

Rates are also calculated for periods shorter than a calendar year. The weekly rate, for example, is calculated by first multiplying the number of weekly deaths by 52 in order to put it on an annual basis. Similarly, crude death rates are calculated on quarterly or half-yearly periods by placing the figures on an annual basis and using the mid-year estimated population as the denominator.

Example: Given below are the numbers of deaths occurring during each of the first six months of 1950 in Egypt. If the estimated population of Egypt for the mid-year of 1950 was 8,349,000, what is the half-yearly death rate for Egypt for the first half of 1950?

Deaths by months in Egypt (1950):

January	February	March	April	May	June
13,087	11,852	11,939	13,776	16,607	18,226

Total number of deaths in the first half year = 85,487
Half-yearly death rate for the first half year of 1950 for Egypt

$$= \frac{85{,}487 \times 2 \times 1000}{8{,}349{,}000} = 20.5$$

To calculate the quarterly crude death rate for Egypt for the first quarter of 1950:
Total number of deaths in the first quarter = 36,878
Quarterly death rate for Egypt for the first quarter of 1950

$$= \frac{36{,}878 \times 4 \times 1000}{8{,}349{,}000} = 17.7$$

Similarly, the monthly crude death rate for January 1950 for Egypt would be:

$$\frac{13{,}087 \times 12 \times 1000}{8{,}349{,}000} = 18.8$$

16.2 Specific death rates

By themselves, crude death rates are not enough for a detailed study of the mortality conditions in a community. We often need to know more about deaths occurring in different sections of the population. For instance, people interested in infant or child welfare work study deaths taking place under 1 year of age or in such age groups as 1-4 years, 5-9 years, etc. Those interested

in maternal health study how many deaths occurred among women of child-bearing age. Insurance companies are interested in deaths occurring at different ages of the population. Public health officers study deaths caused separately by different diseases or injuries. All these require separate classifications of the total number of deaths.

Death rates specific for age, sex, etc. can be calculated in a manner similar to the crude death rate.

16.2.1 *Age-specific death rate*

Example: The mid-year estimated population for Japan for different age groups and the numbers of deaths occurring in each of them during 1950 are given below:

Japan: Population and deaths by age, 1950

Age	Mid-year estimated population	Number of deaths	Age-specific death rate per 1000
under 5 yrs	11,150,000	223,946	20.1
5-9	9,560,000	19,998	2.1
10-14	8,710,000	10,339	1.2
15-19	8,530,000	21,472	2.5
20-24	7,710,000	36,124	4.7
25-29	6,160,000	33,096	5.4
30-34	5,190,000	26,600	5.1
35-39	5,060,000	28,364	5.6
40-44	4,490,000	29,503	6.6
45-49	4,000,000	34,082	8.5
50-54	3,390,000	40,465	11.9
55-59	2,740,000	48,533	17.7
60-64	2,290,000		
65-69	1,760,000	355,602	55.7
70-74	1,290,000		
75 and over	1,040,000		

Specific death rates per 1000 population for age-group under 5 years

$$= \frac{223,946}{11,150,000} \times 1000 = 20.1 \text{ per } 1000$$

Rates computed for the entire life span invariably show high mortality operating at the two ends of life, i.e. among infants and old persons. This feature is further illustrated in figure 16.2a, showing for each age-group three values of the specific death rates corresponding to the periods 1851-55, 1901-05 and 1951-55. Even though in each age-group there has been a decrease over the century, the characteristic age variation has persisted throughout the period. The trend of the age-specific death rates per 1000 population for England and Wales from 1850 to 1950 is shown in Fig. 16.2b. The rates are studied separately for each sex.

16.2.2 *Specific death rate by sex*

When age-specific death rates are calculated separately for each sex, the mortality is generally at a lower level among females than among males. However, in the reproductive age-groups mortality among women may be higher than for men because of lack of medical care of the mother.

SPECIFIC DEATH RATES BY AGE, ENGLAND AND WALES, DURING THE PERIODS 1851-55, 1901-05, 1951-55
(Rates are deaths per 1000 population)

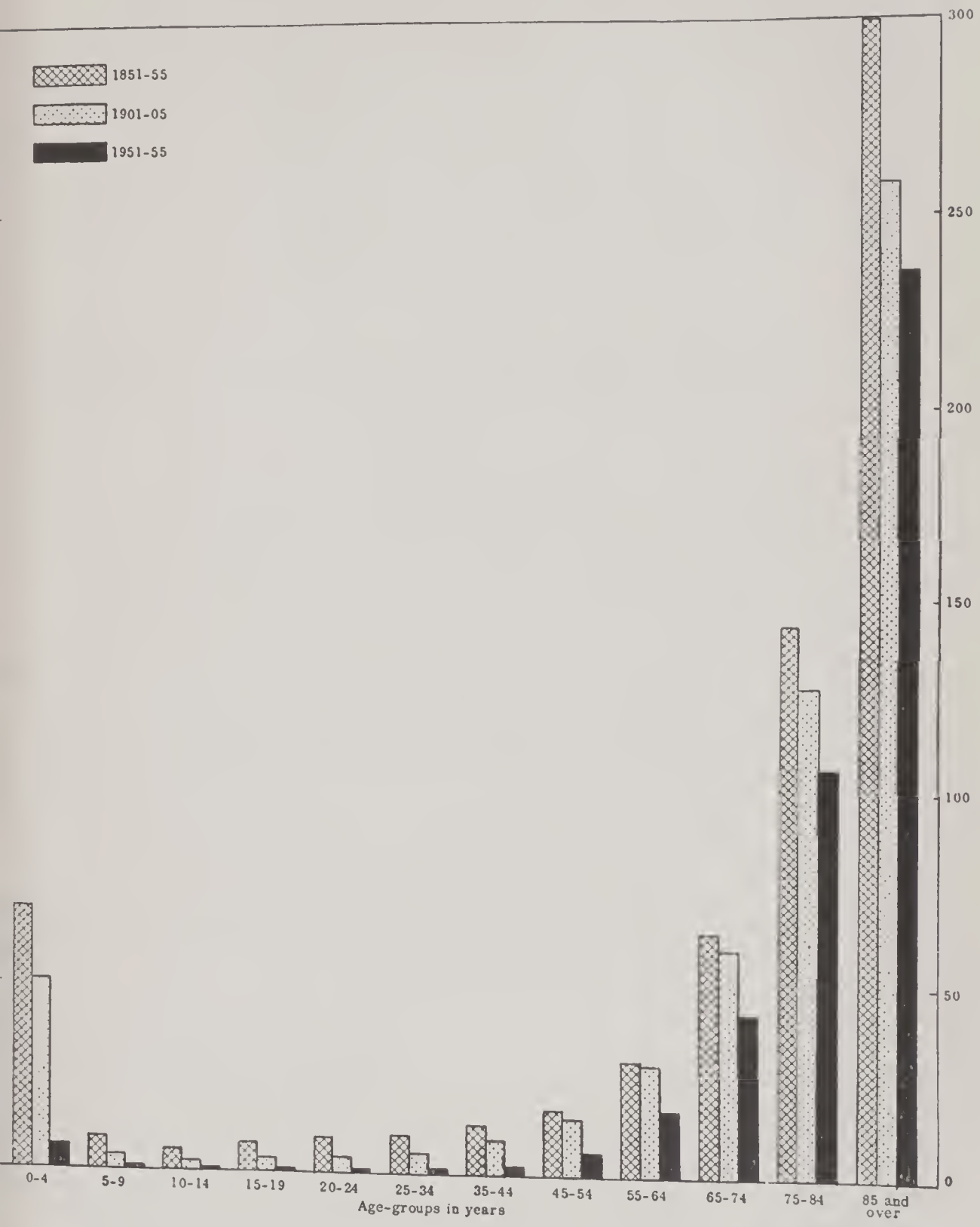
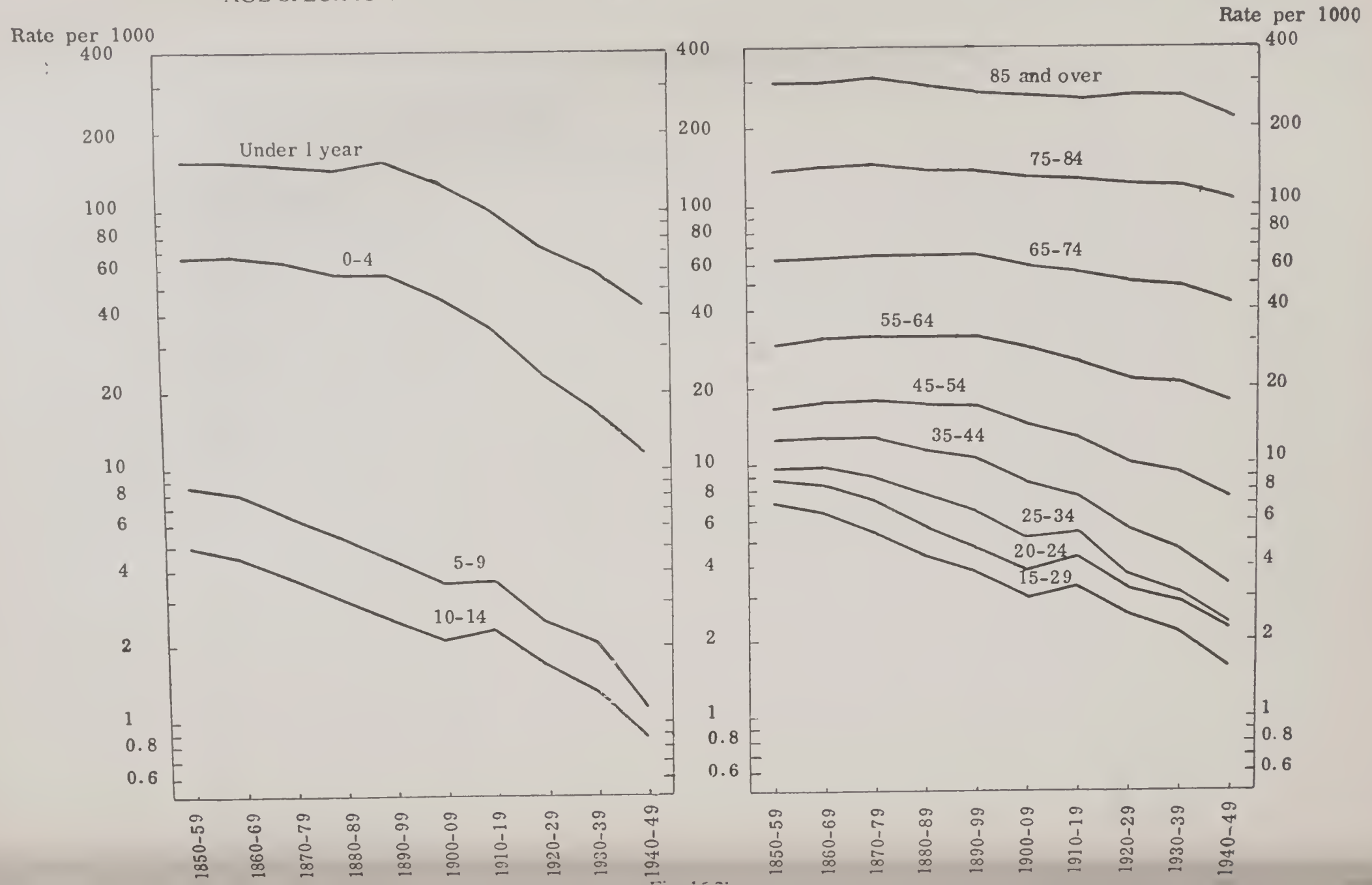


Fig. 16.2a

AGE SPECIFIC DEATH RATES PER 1000 POPULATION, ENGLAND AND WALES, 1850-1950



In Israel for instance for the age group 25-29 years the age-specific death rates per 1000 for males and females during 1944 were 1.3 and 1.6 respectively. In 1955, the rate had become the same, 1.0 for both sex groups.

16.3 Cause-of-death rate

Most death rates by cause are computed on total population; the exceptions being the infant mortality rate and some age, sex specific rates. The formula for cause-of-death rate is:

$$\text{Annual cause-of-death rate} = \frac{\text{Number of deaths from a specified cause which occurred among the population of a given geographic area during a given year}}{\text{Mid-year total population of the given geographic area during the same year}} \times 100{,}000$$

The numerator of this rate is often small. For this reason the formula uses a multiplying factor of 100,000 rather than the usual 1000 so that the computed rates are not expressed as small decimal fractions.

Example: There were 3001 deaths from tuberculosis of the respiratory system in Canada in 1950. The mid-year estimated population for Canada for 1950 was 13,821,000. To calculate the tuberculosis death rate of Canada for 1950:

$$\text{Tuberculosis death rate, Canada 1950} = \frac{3001 \times 100{,}000}{13{,}821{,}000} = 22 \text{ per } 100{,}000$$

We can calculate cause-of-death rates specific for age and sex as in the example below:

In Canada in 1950 there were 106 deaths due to tuberculosis among males aged 25-29, and 162 deaths from the same cause among females of the same age group. The mid-year male and female populations in 1950 for these two groups were 558,800 and 558,400 respectively. To calculate the age and sex specific death rates of tuberculosis:

Specific death rates for tuberculosis among males aged 25-29

$$= \frac{106 \times 100{,}000}{558{,}800} = 19 \text{ per } 100{,}000$$

Specific death rates for tuberculosis among females aged 25-29

$$= \frac{162 \times 100{,}000}{558{,}400} = 29 \text{ per } 100{,}000$$

16.4 Infant mortality rate

For a health worker, mortality rate among infants is of special significance because it is regarded as one of the most sensitive indexes of health conditions of the general population. It is a sensitive measure of health because a baby in its extra-uterine life is suddenly exposed to a multitude of new environmental factors and their reactions are reflected in this rate. Under ideal social welfare no baby should die, except possibly the few who are born with serious handicaps such as congenital disabilities or disorders originating in uterine life. If, therefore, the mortality rate among infants is low, it suggests that:

(a) From the health officer's point of view, the immunization programme is adequate, the nutrition of the mother and the baby is sound, antenatal and postnatal work is satisfactory, diseases are controlled and strict laws govern the administration of health programmes.

(b) From the sanitarian's point of view environmental sanitation is good, water supply is protected, flies, mosquitos and other insect vectors and rodents are under control, and housing facilities are adequate and conducive to health.

(c) From the social worker's point of view it implies that illegitimate children are not neglected, girl babies are not unwelcome and the level of living is high.

Many statistical studies have shown that if any of these conditions is not fulfilled, the effect is reflected in an increase in the rate of infant mortality.

The computation of the infant mortality rate on the basis of the population of infants presents difficulty because the infants are usually under-enumerated. Sometimes the estimates of the population by age are not available. For the calculation of this rate the population of infants in the denominator is therefore substituted by the number of live births. The formula for its calculation is:

$$\text{Annual infant mortality rate} = \frac{\text{Number of deaths under one year of age which occurred among the population of a given geographic area during a given year}}{\text{Number of live births which occurred among the population of the given geographic area during the same year}} \times 1000$$

Example: During 1950 the number of live births in England and Wales was 697,097. The number of infant deaths during the same year was 20,817. The infant mortality rate for England and Wales for 1950 would therefore be

$$\frac{20{,}817 \times 1000}{697{,}097} = 29.9 \text{ per } 1000 \text{ live births.}$$

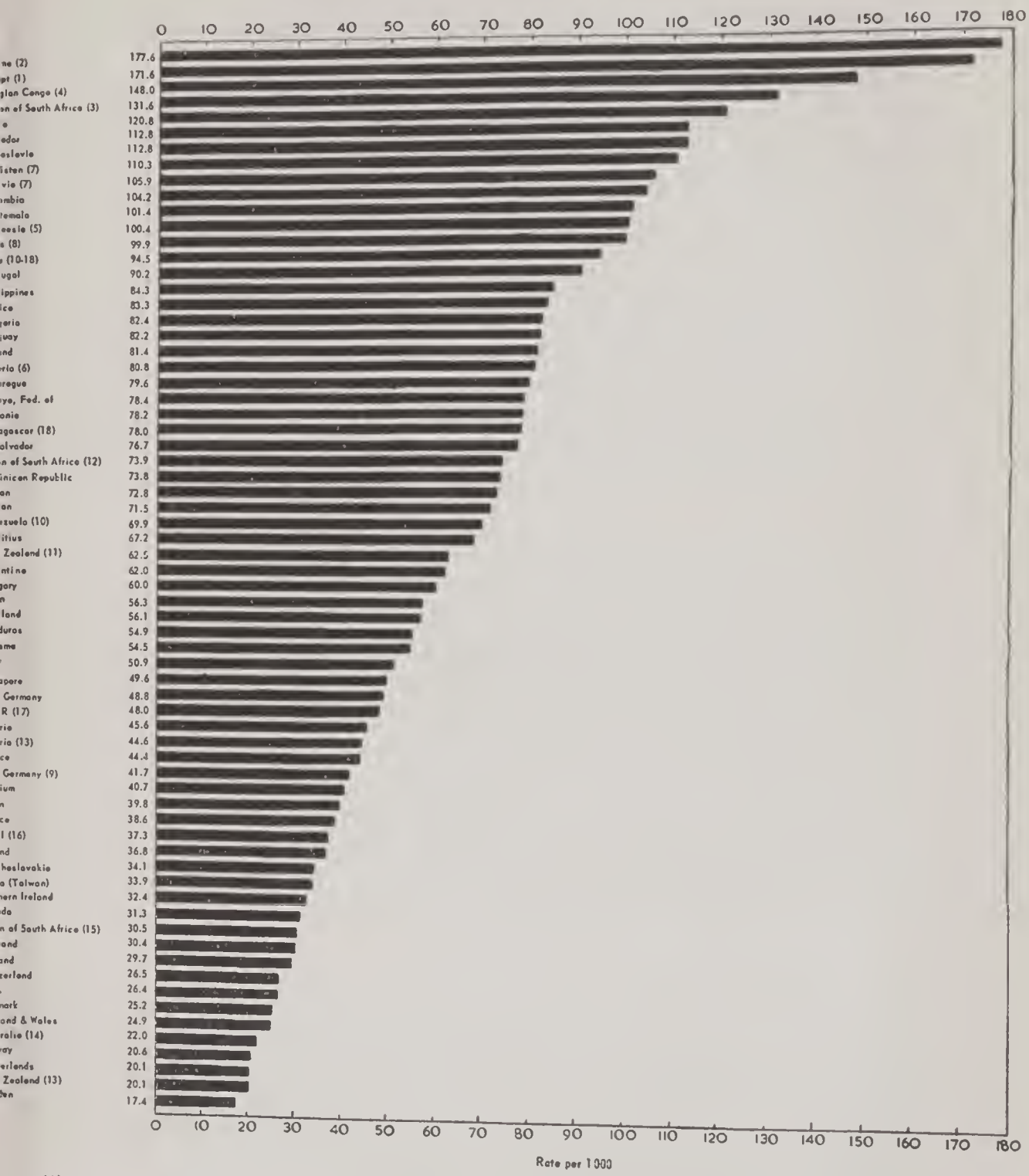
Fig. 16.4a presents the annual infant mortality rates for 68 countries for the year 1955.

Age-specific death rates for infants based on population are sometimes used when rates are computed systematically for age groups covering the whole life span. But the use of the number of live births has the additional advantage that it eliminates dependence on the population census. The infant mortality rate can be computed for any area or time period, provided the numbers of infant deaths and live births are known.

Comparison of infant mortality rates enables one to locate populations where the rate is high and thus provide indication of the need for special action. For example, in 1949 the rate in New Delhi was 53 but in contiguous Old Delhi it was as high as 108, thus pointing to the population more in need of concerted action. In many parts of the world, when the infant mortality rate is computed separately for urban and rural areas the unequal distribution of health facilities is brought out sharply. But in calculating the rate for

INFANT MORTALITY RATE IN 68 COUNTRIES, 1955.

Rates are infant deaths per 1000 live births



(1) 1954, Health Bureau; (2) 61 towns only; (3) Coloured population (mixed); (4) Indigenous population; (5) 91 Regencies in Java; (6) Moslem population; (7) 1951, Registration area, excluding live-born infants dying before registration of birth; (8) Registration area, excluding data for Bihar, Madhya Pradesh and Orissa; (9) Including the Saar; (10) Excluding Indian jungle population; (11) Maori population; (12) Asiatic population; (13) European population; (14) Excluding full-blooded aborigines; (15) White population; (16) Excluding Bedouin population in the Negev; (17) 1953; (18) 1954.

Fig. 16.4a

urban populations it has to be noted that frequently, owing to better hospital facilities in cities or towns, maternity cases are attracted from the adjoining rural areas. We should therefore exclude all births occurring in urban maternity institutions if the normal place of residence of the mother is outside the area.

The infant mortality rate is studied separately for geographical subdivisions or for specific population groups. As a matter of fact, it is a problem that needs study and attack on a wider front, and the health worker should consider the effect of such factors as overcrowding, unemployment, social habits and customs, food habits, topography, occupation of parents and illegitimacy.

It is universally true that mortality in the first year of human life is high, higher than at any age except among the very old. In many countries it is about 20 to 50 times higher than in the age-group 10-15 years. Fig. 16.4b illustrates, from German experience, this characteristic feature of the risk to life separately during the first 24 hours by hour, by days during the first week, and by months during the first year. The variation of the mortality rate at different ages throughout the whole life span is shown in the fourth diagram.

In all the advanced countries there has been a marked reduction in the infant mortality rate during recent years, (see Fig 16.4c).

Since the infant mortality rate is of special significance in health work, its correct computation and interpretation is important. Errors in the rate arise from wrong use of the definition or under-registration of vital events. For instance, variation in the definition of the terms "live birth" and "foetal death" may produce appreciable differences. Liveborn infants who die at birth or very soon after, may fail to be registered as live births. On the other hand, by improving the registration of live births, a higher figure in the denominator will automatically produce a reduced infant death rate. It has therefore been said that (statistically speaking) it is possible to lower the infant mortality rate even without a reduction in infant deaths.

16.4.1 *Neonatal mortality rate*

As shown in Fig. 16.4b, infant mortality is studied in detail by classifying deaths first by the age of the infant. As stated in section 13.5, in accordance with the WHO Regulations No. 1, deaths in the first year of life are classified by single days for the first week of life, by weeks up to the fourth, and then by single months up to age 1 year. For deaths occurring under 28 days a rate called the neonatal mortality rate is calculated:

$$\text{Annual neonatal mortality rate} = \frac{\text{Number of deaths under 28 days of age which occurred among the population of a given geographic area during a given year}}{\text{Number of live births which occurred among the population of the given geographic area during the same year}} \times 1000$$

MORTALITY RATES AT DIFFERENT AGES, UNDER 24 HOURS, UNDER 1 WEEK, UNDER 1 YEAR AND OVER THE ENTIRE LIFE SPAN. FEDERAL REPUBLIC OF GERMANY 1951

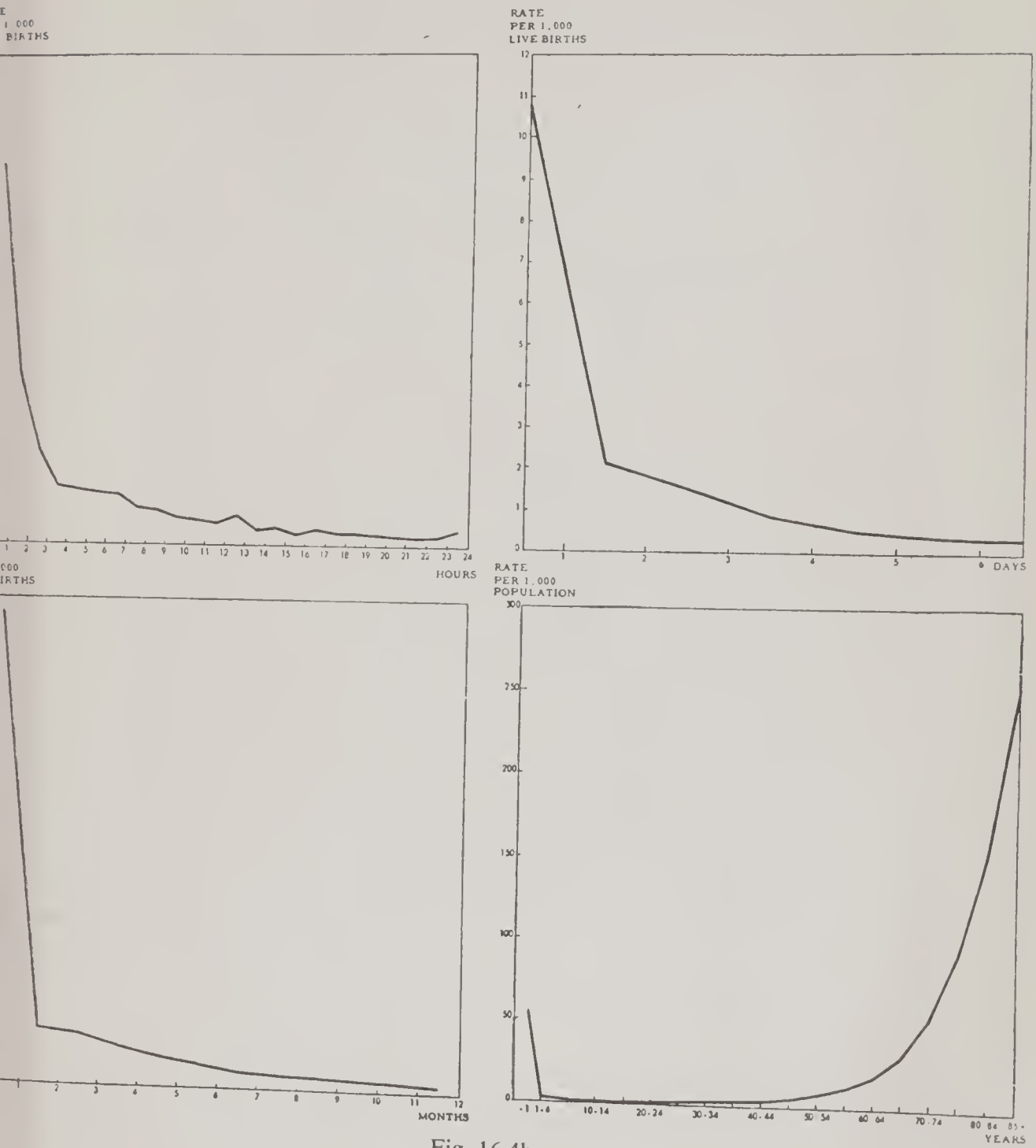


Fig. 16.4b

TREND OF INFANT MORTALITY IN SELECTED COUNTRIES, 1751-55 TO 1951-55
(five-year average rates per 1000 live births)

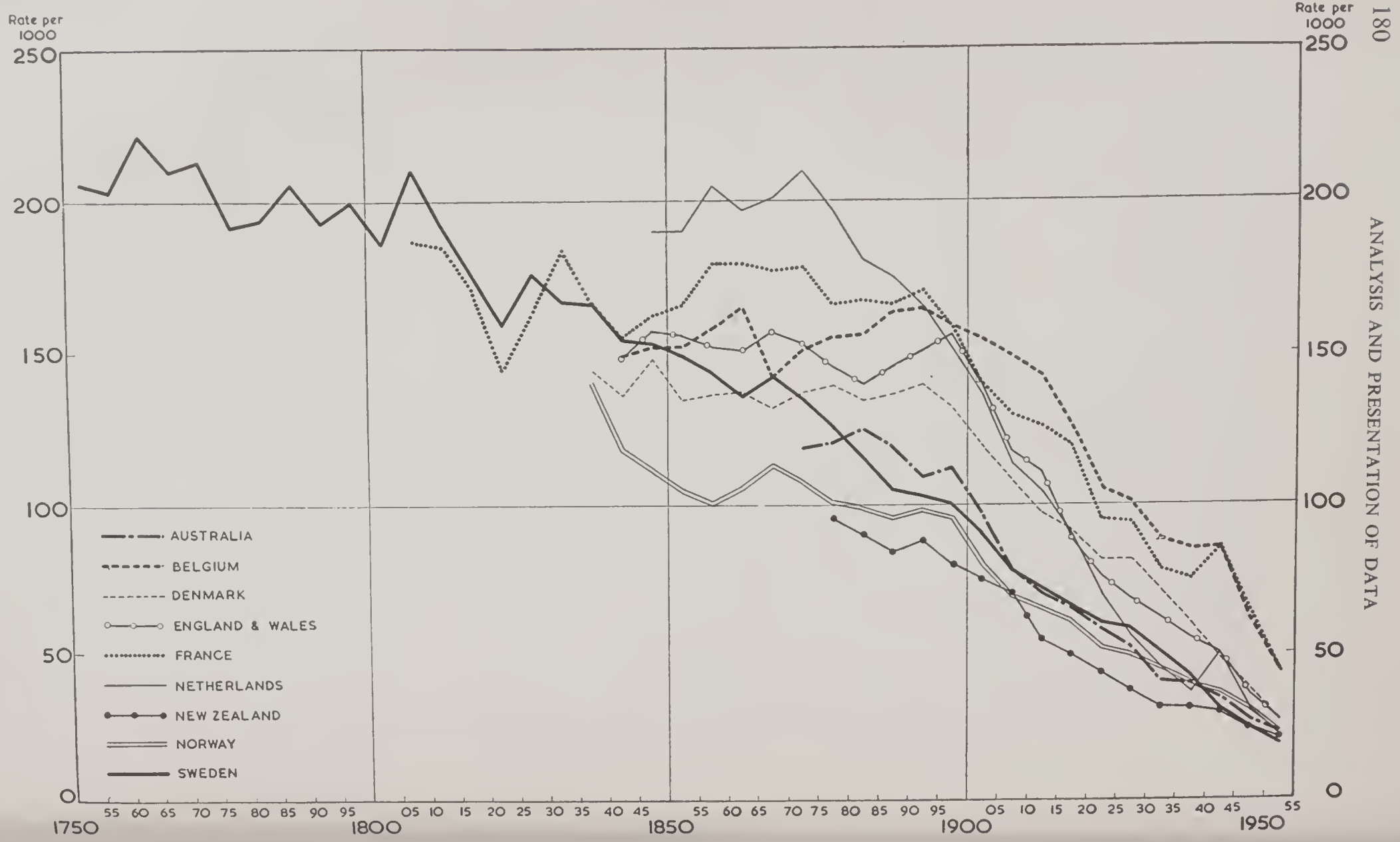


Fig. 16.4c

16.4.2 *Foetal death ratio*

In Chapter 13 the definition of the term "foetal death" has been given. For international comparability the WHO Expert Committee on Health Statistics has recommended that foetal death ratio be computed on the basis of live births. As the registration of all foetal deaths is incomplete, better figures are obtained if the calculation of this ratio is limited to late foetal deaths (stillbirths). This ratio relates the number of late foetal deaths to the number of live births:

$$\text{Annual late foetal death ratio} = \frac{\text{Number of foetal deaths of 28 or more completed weeks of gestation which occurred among the population of a given geographic area during a given year}}{\text{Number of live births which occurred among the population of the given geographic area during the same year.}} \times 1000$$

Another name for this ratio is the "stillbirth ratio".

16.4.3 *Perinatal mortality rate*

Many late foetal deaths and early neonatal deaths may be attributed to similar underlying conditions and it has been suggested that a single rate called the perinatal mortality rate be calculated by combining the deaths in both the categories. The idea is to include the period of prenatal existence after the foetus is considered viable, i.e., foetal deaths occurring after 20 or 28 completed weeks of gestation, the duration of labour and the early part of the postnatal life. Some prefer to restrict the postnatal period to under 7 days, others to the neonatal period, i.e., under 28 days. No agreement has yet been reached on these points or on the denominator to be used, i.e. whether it should be only the live births or the sum of live births and foetal deaths. In setting out the rate of perinatal mortality the terms should therefore be clearly defined. At its Sixth National Meeting in 1956, the USA Public Health Conference on Records and Statistics proposed this definition of the perinatal mortality rate for general use in analysis of vital records:

$$\text{Perinatal mortality rate} = \frac{\text{Foetal deaths (20 weeks or more)} + \text{postnatal deaths (under 1 week)}}{\text{Foetal deaths (20 weeks or more)} + \text{live births}} \times 1000$$

The formula used in WHO publications[1] is as follows:

$$\text{Perinatal mortality rate} = \frac{\text{Late foetal deaths (28 weeks or more)} + \text{deaths under one week}}{\text{Live births}} \times 1000$$

16.4.4 *Post-neonatal mortality rate or late infant mortality rate*

In contrast with the neonatal mortality rate, the death rate of infants dying from 28 days to under 1 year, is calculated as follows:

[1] See: Monthly Epidemiological and Vital Statistics Report, Vol. 10, No. 11-12, 1957.

$$\text{Post-neonatal mortality rate (or late infant mortality rate)} = \frac{\text{Deaths of infants 28 days to under 1 year}}{\text{Live births}} \times 1000$$

The infant mortality rate is then the sum of the neonatal and the post-neonatal mortality rates.

16.5 Maternal mortality rate

The risk of dying from causes associated with childbirth is measured by the maternal mortality rate. For this purpose the deaths used in the numerator are those arising from puerperal causes, i.e. deaths falling under the code numbers 640-648, 650-689 (Deliveries and complications of pregnancy, childbirth and the puerperium) of the International Statistical Classification of Diseases, Injuries and Causes of Death.

The numbers exposed to the risk of dying from puerperal causes are women who have been pregnant during the period. Their number being unknown the number of live births is used as the conventional base for computing comparable maternal mortality rates. The formula is:

$$\text{Annual maternal mortality rate} = \frac{\text{Number of deaths from puerperal causes which occurred among the female population of a given geographic area during a given year}}{\text{Number of live births which occurred among the population of the given geographic area during the same year}} \times 1000$$

The classification and coding of deaths as puerperal deaths vary from one country to another or even within the same country, so we must be cautious in comparing maternal mortality rates for different places.

16.6 Proportional mortality rate

This rate by cause of death is obtained by dividing the number of deaths from a specific cause by the total number of deaths occurring in the population. It is generally expressed as a percentage. The proportional mortality rate is used for describing the relative importance of different fatal diseases in a population. Proportional mortality rates can be calculated for specific age-groups and are useful for determining the order of importance of causes of death in different age-groups.

One disadvantage in the use of proportional mortality rates is that when due to an epidemic of a single disease, the total number of deaths in any year is considerably increased, the proportional mortality from the other causes is correspondingly reduced, even if there may not have been any absolute decrease in deaths from those other causes.

The use of the percentage of deaths of persons 50 years and over to total deaths has been suggested in connexion with studies on the levels of health, (see Section 20.5).

16.7 Adjusted or standardized rates

The crude death rates of two or more places cannot be compared when their populations have different age compositions. This point is illustrated

by a hypothetical example of three areas, A, B and C, for which the specific death rates by age and the corresponding populations are given.

Age-group	Death rates per 1000			Population in thousands			Deaths at each age		
	A	B	C	A	B	C	A	B	C
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
0-14	15	16	17	4000	3,500	3,000	60	56	51
15-29	10	11	12	2000	3,000	3,500	20	33	42
30-44	14	15	16	1500	2,000	2,500	21	30	40
45+	40	45	50	2500	1,500	1,000	100	68	50
				10,000	10,000	10,000	20.1	18.7	18.3

It is clear from columns (2) to (4) that at each age-group area A enjoyed the lowest death rate and area C had the highest. The crude death rates shown at the bottom of the columns (8) to (10) on the other hand, lead to contradictory conclusions, as the crude death rate of Area A is the highest. This fallacious conclusion arises because of marked differences in the age composition, area A having the largest proportion of old people. As a general rule an area which has a greater number of old persons would tend to have a higher crude death rate than an area with a large proportion of young people. To compare the overall death rate of different populations, we should ascertain how much of the difference in the rates is due to the unfavourable age distribution of the populations. One method that has been adopted to eliminate the effect of varying age or sex composition is to compute what would

Age-group	Standard million for India, 1951		Specific death rates per 1000, Calcutta, 1951		Deaths that would have occurred in the standard population from specific death rates of Calcutta	
	Males	Females	Males	Females	Males	Females
0-	13,265	14,029	278.3	217.9	3,692	3,057
1-4	45,563	46,313	45.5	48.0	2,073	2,223
5-9	51,738	51,403	10.6	11.4	548	586
10-14	48,320	47,902	4.5	5.0	217	240
15-19	45,728	45,781	4.4	10.4	201	476
20-29	84,230	85,576	5.8	12.5	489	1,070
30-39	73,108	72,878	6.6	12.5	483	911
40-49	59,648	57,252	11.0	14.2	656	813
50-59	43,130	41,657	24.3	27.0	1,048	1,125
60+	34,273	38,206	65.2	72.5	2,235	2,770
All ages	499,003	500,997	15.6	24.0	11,642	13,271
All ages both sexes	1,000,000		18.6		24,913	

Adjusted or standardized death rate $= \frac{24{,}913 \times 1{,}000}{1{,}000{,}000} = 24.9$

The numbers in the last two columns are obtained as follows: the first number, viz. 3,692 is obtained by applying the rate 278.3 to the number of male childeren under 1 year of age, i.e., 13,265; $(\frac{13{,}265 \times 278.3}{1000}) = 3{,}692$ and so on.

have been the death rate if the age compositions were the same. This is known as the direct method of standardization and is illustrated below by comparing the death rate for Calcutta City with that of India as a whole. The specific death rates by age and sex for Calcutta City and the age and sex distribution of the population of India are given. India's population distribution was calculated for each age and sex group in such a manner as to give a total of 1 million persons, preserving the same proportional age and sex distribution as in the total population. This may be called the standard million population for India. Each specific death rate for Calcutta was multiplied with the corresponding population in the standard million to obtain the expected number of deaths. The total deaths thus obtained are divided by 1 million and converted to rate per 1000. The single rate resulting from this adjustment is called the "standardized", "adjusted" 'or "corrected" death rate.

The crude death rate of Calcutta City was 18.6 but after correction for age and sex composition the death rate becomes 24.9. This would have been the death rate of Calcutta if the City had the same age/sex composition as for the Indian population of 1951. If we want to compare the death rate of Bombay City with Calcutta's death rate, we must carry out the same computation using Bombay's age and sex specific death rates and applying them to the standard million population of India.

This method requires information on the age and sex distribution of the people of the areas to be compared as well as the age and sex distribution of the deaths in the areas. Sometimes this information is not available and even if available the specific death rates calculated for some age-groups are subject to large fluctuations due to small numbers. In such instances the indirect method of adjustment or standardization is used.

The indirect method requires a knowledge only of the age and sex compositions of the populations to be compared. The specific death rates of the standard population are applied to the respective age-groups of the populations of the areas to be compared. The deaths expected in each age-group are added and divided by the total population of the area to first obtain what is known as the index death rate, indicating what would have been the death rate if the area had experienced the mortality rates of the standard population.

The ratio of the crude death rate of the standard population to the index death rate is known as the standardization factor because it gives the correction necessary for the crude death rate of the area owing to its difference in age composition from that of the standard population. Here is an example of standardization by the indirect method:

Age and sex distribution of the population of Calcutta City in 1951 and the specific death rates for India are given below. The crude death rates of Calcutta and of India were 18.6 and 14.4 respectively.

Age-group	Population of Calcutta, 1951		Standard specific death rates of India, 1951		Deaths that would have occurred in Calcutta population if standard specific death rates of India were operative	
	Males	Females	Males	Females	Males	Females
0-	22,712	25,825	102.4	88.8	2,326	2,293
1-4	87,716	87,244	25.9	24.1	2,272	2,103
5-9	112,464	108,723	6.5	6.0	731	652
10-14	141,316	117,611	5.1	4.9	721	576
15-19	198,133	110,821	5.7	6.4	1,129	709
20-29	403,476	175,424	5.6	6.6	2,259	1,158
30-39	315,412	123,008	7.6	7.9	2,397	972
40-49	195,677	81,774	11.6	10.1	2,270	826
50-59	94,013	51,810	19.0	16.0	1,786	829
60+	52,292	43,226	46.3	42.3	2,421	1,828
All ages	1,623,211	925,466	14.7	14.0	18,312	11,946
All ages both sexes	2,548,677		14.4		30,258	

The numbers in the last two columns are obtained by applying the specific death rates of India to the appropriate age-groups. For example, for the age-group 1-4 years the expected male deaths are:

$$\frac{87{,}716 \times 25.9}{1000} = 2{,}272, \text{ and so on.}$$

$$\text{Index death rate for Calcutta} = \frac{30{,}258 \times 1000}{2{,}548{,}677} = 11.9$$

Crude death rate for India = 14.4

$$\text{Standardizing factor} = \frac{14.4}{11.9} = 1.21$$

Standardized death rate for Calcutta = crude death rate for Calcutta multiplied by the standardizing factor = $18.6 \times 1.21 = 22.5$

From the above calculation it follows that the death rate of 18.6 per 1000 for Calcutta cannot be compared with the death rate of 14.4 per 1000 for India because of differences in age composition.

Both the direct and indirect methods of age adjustments have been criticised on the ground that the rates obtained are also dependent on the age and sex structure of the standard population used and that greater gains in mortality reduction obtained at younger ages are not adequately accounted for.

Yerushalmy and Kohn have suggested methods intended to take into account the more important improvements in the mortality at young ages. An excellent review of these procedures appears in "Elements of Vital Statistics" by B. Benjamin.

16.8 Occupational mortality comparisons

As the age structure of the populations constituting different occupational classes varies considerably, some method of adjustment is needed in order

that the mortality rate at 20-64 years in the various occupational classes may be compared more accurately.

Two indices used are the standardized mortality ratio and the comparative mortality figure.

16.8.1 *Standardized Mortality Ratio (S.M.R.)*

This is the number of deaths occurring among men aged 20-64 years in a given occupation, expressed as a percentage of the number of deaths that might have been expected to occur if the given occupation had experienced within each age-group the same death rate as that of a standard population consisting either of all males or of all occupied and retired males only. The concept used is that of the indirect method of standardization.

16.8.2 *Comparative Mortality Figure (C.M.F.)*

This is the number of deaths that would occur in a given occupational group if the population engaged in that occupation were the same in size and age distribution as a standard population in which under prevailing general mortality conditions 1000 deaths are expected to occur. The standard population may consist either of all males aged 20-64 years, or only of all occupied and retired males at those ages. The reasoning follows the direct method of standardization. (See: Registrar General's Decennial Supplement, England and Wales 1951. Occupational Mortality Part I).

16.9 Crude birth rate

As an index of the relative speed at which additions are being made to the population through childbirth, use is made of the crude birth rate. The formula is:

$$\text{Annual crude livebirth rate} = \frac{\text{Number of live births which occurred among the population of a given geographic area during a given year}}{\text{Mid-year total population of the given geographic area during the same year.}} \times 1000$$

The rate is a composite measure of several factors affecting natality in the population, viz. the age and sex composition, marriage rate, economic level, the true fertility, migration, etc. In spite of this limitation the rate is widely used because of the general availability of the data.

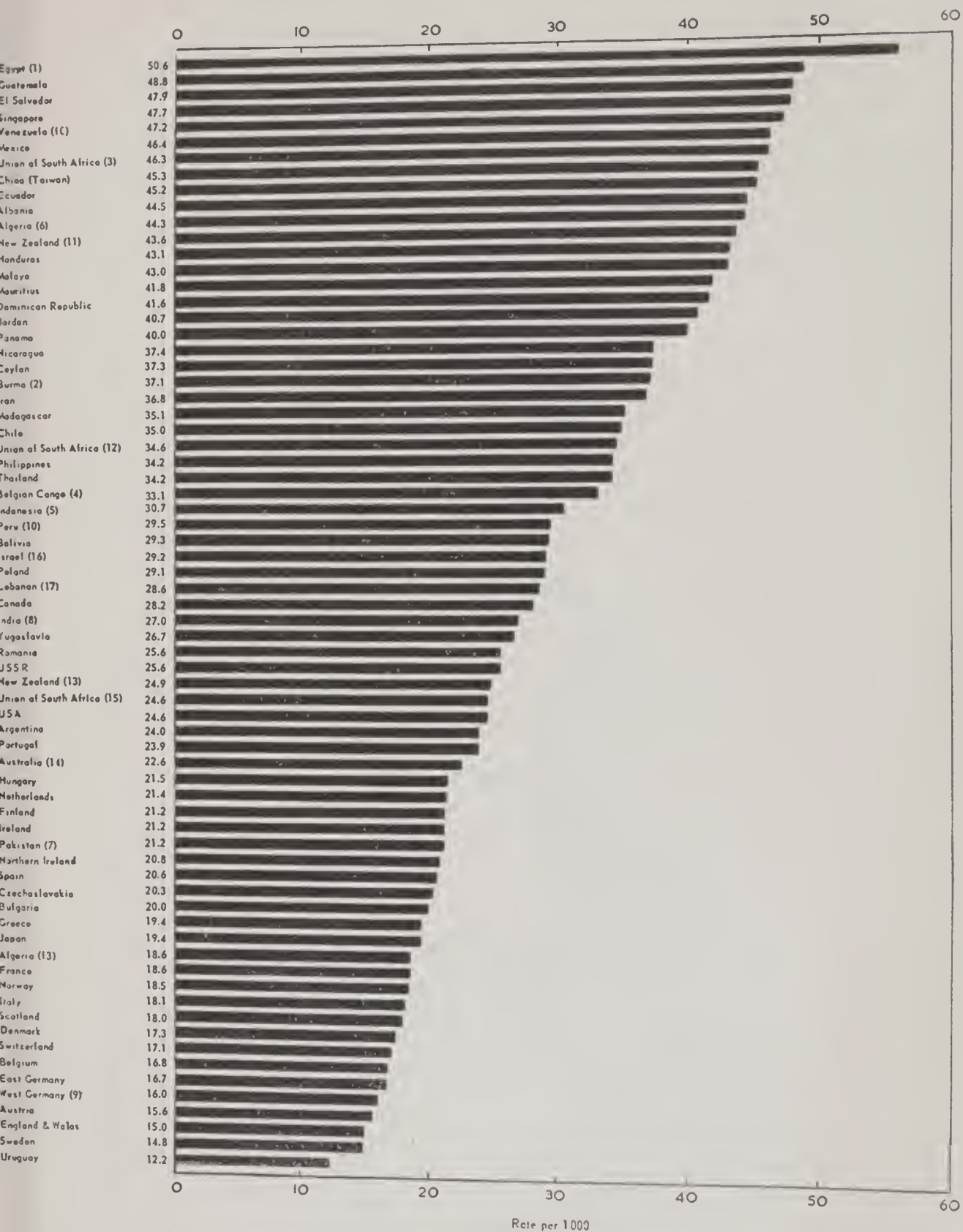
A comparison of the crude birth rates for 70 countries is made in Fig. 16.9a. The trend of the rate over a long number of years in some countries is shown in Fig. 16.9b. The effect of the two world wars on the rate is well brought out.

16.9.1 *Fertility rate*

The number of births in a population is largely dependent upon the proportion of women of childbearing age, especially the married women. A more appropriate measure of the fertility of a population is therefore obtained if we relate live births to the total women in the reproductive age

CRUDE BIRTH RATE IN 70 COUNTRIES, 1955.

(Rates are number of births per 1000 pop.)

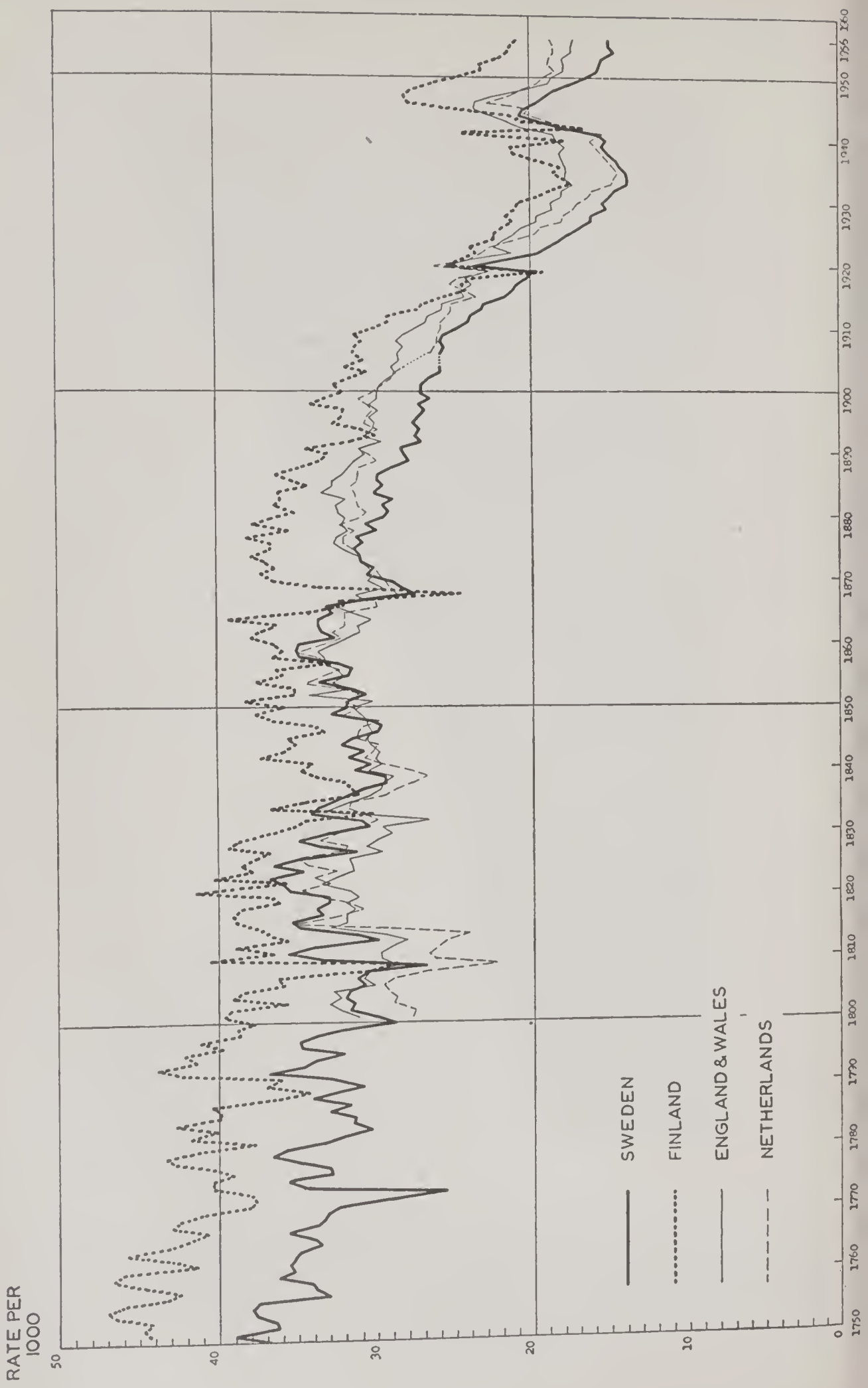


(1) 1954, Health Bureau; (2) 61 towns only; (3) Coloured population (mixed); (4) Indigenous population; (5) 91 Regencies in Java; (6) Moslem population; (7) 1951, Registration area, exeluding live-born infants dying before registration of birth; (8) Registration area, exeluding data for Bihar, Madhya Pradesh and Orissa; (9) Including the Saar; (10) Excluding Indian jungle population; (11) Maori population; (12) Asiatic population; (13) European population; (14) Excluding full-blooded aborigines; (15) White population; (16) Exeluding Bedouin population in the Negev; (17) 1953.

Fig. 16.9a

TREND OF THE ANNUAL CRUDE BIRTH RATE IN CERTAIN COUNTRIES, 1750-1956

A. 1750-1956



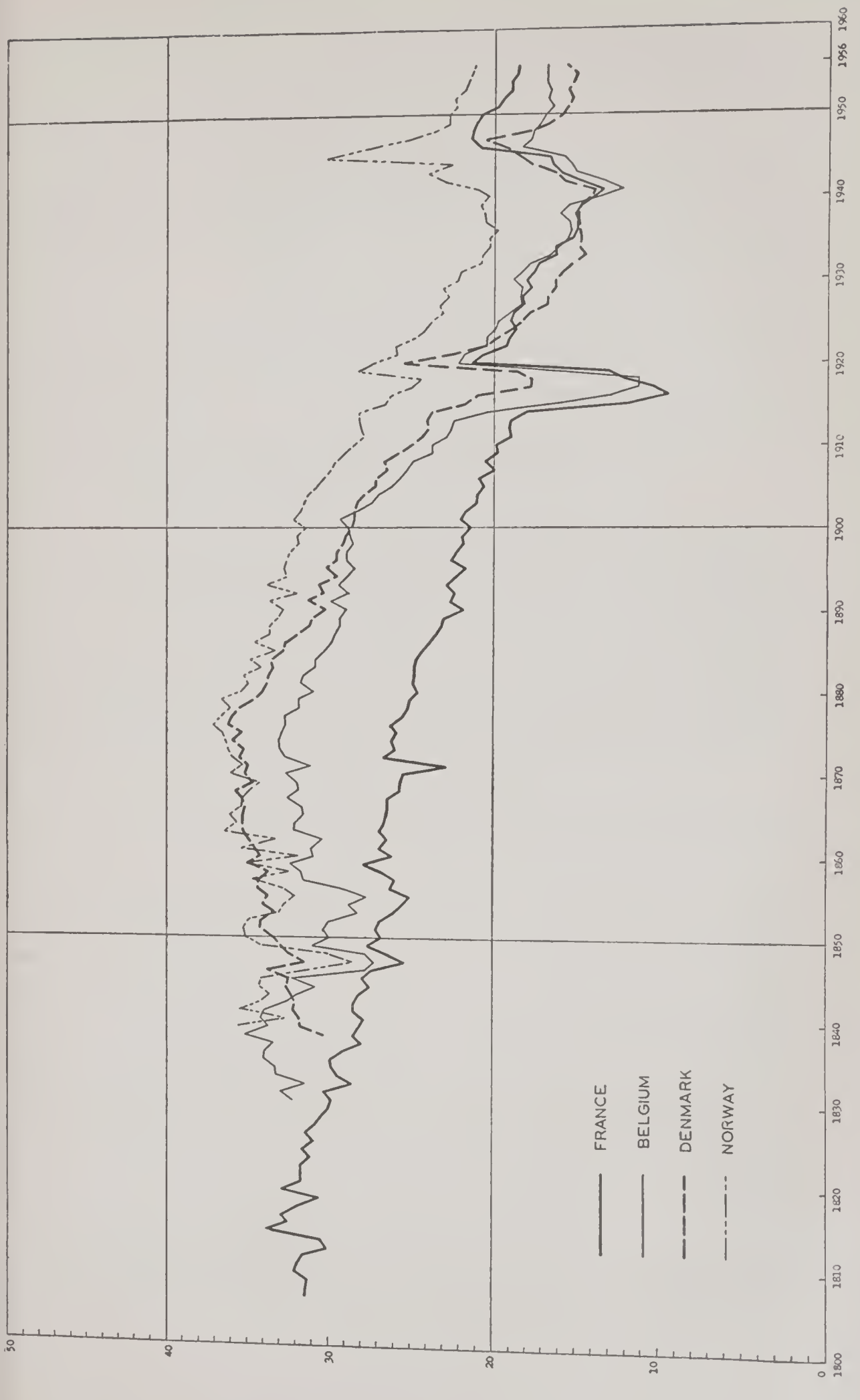


Fig. 16.9b (continued)

period, viz. 15-49 years. The rate is known as the general fertility rate or age-limited live birth rate, calculated as follows:

$$\text{General fertility rate} = \frac{\text{Number of live births in one year}}{\text{Number of women in age-group 15-49 years}} \times 1000$$

The numerator consists of all live births, whether legitimate or illegitimate, and the denominator comprises all women of ages 15 to 49 years, whether married or unmarried. More specifically we may calculate what are known as age-specific fertility rates.

16.9.2 *Age-specific fertility rate*

These take account of the age-sex composition of populations and, therefore, provide better basis for comparisons of natality. They are also useful in analysing the historical trend of the live-birth rate for various ages. The formula for the age-specific birth rate is:

$$\text{Annual live-birth rate specific for age of mother (or father)} = \frac{\text{Number of live births which occurred to mothers (or fathers) of a specified age group of the population of a given geographic area during a given year}}{\text{Mid-year female (or male) population of the specified age group in the given geographic area during the same year}} \times 1000$$

Example: In France there were 288,731 live births in the year 1950 to mothers aged 25-29 and the estimated population of women in the same age group was 1,637,000. The specific fertility rate of women for the age group 25-29 years is:

$$\frac{288{,}731 \times 1000}{1{,}637{,}000} = 176 \text{ per } 1000$$

Similar rates can be calculated for individual years of age.

16.10 Sex ratio at birth

Sex ratio at birth is the number of liveborn males per 100 liveborn females in the specified period.

16.11 Illegitimacy rate

The following indices are used:

$$\text{Illegitimate fertility rate} = \frac{\text{The number of illegitimate live births in a given population in a specified period}}{\text{The number of unmarried women and widows in the same population in the middle of the period}} \times 1000$$

$$\text{Illegitimacy ratio} = \frac{\text{Number of illegitimate live births in a given population during a specified period}}{\text{Total number of live births in the same population during the same period}} \times 100$$

16.12 Natural increase rate

The balance of births over deaths, i.e. natural increase per 1000 population, gives a measure of the net gain or loss through the addition of births and subtraction of deaths.

The formula for the natural increase rate is:

$$\text{Annual natural increase rate} = \frac{\text{Number of births which occurred among a population of a given geographic area during a given year minus the corresponding number of deaths}}{\text{Mid-year population of the given geographic area during the same year}} \times 1000$$

The rate can also be obtained by subtracting the crude death rate from the crude birth rate.

16.13 Vital index

A percentage of births to deaths was used at one time to describe the reproductivity of population. This index is no longer in use.

16.14 Gross reproduction rate

The gross reproduction rate is the sum of age-specific fertility rates calculated from female births for each single year of age. It provides a hypothetical upper limit of the rate of population growth indicating the average number of daughters that would be born to a group of women beginning life together, if none died or migrated before reaching the upper limit of childbearing age. Another underlying assumption is that the same fertility rates continued to be in operation. A rate of 1 would indicate that on the basis of current fertility and without any mortality, the present generation of childbearing women would maintain itself exactly.

If the age specific rates are not available for single years of life but only for age-groups, each such rate should first be multiplied by the number of years covered by the age group before being added.

16.15 Net reproduction rate

The net reproduction rate is obtained by multiplying the female specific fertility rates of each age by the proportion of female survivors to that age in a life table (see chapter 18), and adding up the products. An allowance is thus made for mortality. This rate estimates the average number of daughters that would be produced by women throughout their lifetime if they were exposed at each age to the fertility and mortality rates on which the calculation is based. It thus indicates the rate at which the number of female births would eventually grow per generation if the same fertility and mortality rates remained in operation. A net reproduction rate of 1, indicates that on the basis of the current fertility and female mortality, the present female generation is exactly maintaining itself.

A further discussion of these rates is beyond the scope of this chapter. For further details reference should be made to "Introduction to Demography" by Mortimer Spiegelman, The Society of Actuaries, Chicago, Ill., 1955.

CHAPTER 17

Measurement of Morbidity

17.1 Introduction

The need for and importance of statistics on sickness have already been described in Chapter 6. In this rapidly developing field many statistical considerations enter, depending on the purpose for which the data are assembled. For specific preventive action, the epidemiology of the disease has first to be understood in relation to local circumstances. For this purpose, of course, specialized studies are needed. But even when the epidemiological considerations are fairly well elucidated the total magnitude of the problem and its characteristic variations in respect of season or longer periods of time, or by age, sex and other population characteristics, require assessment. Sometimes, even a cursory examination of the figures from institutions such as hospitals and dispensaries is helpful in drawing attention to mass diseases affecting an area and deserving priority. For instance, the importance of malaria, bilharziasis, or trachoma, may well be emphasized from data obtained in this manner. But once the health agency has been operating in the area for some time and the mass diseases are brought under relative check, more refined methods are required to assess the magnitude and priority of various morbid conditions, and the nature of their variations, in order to direct more specific measures against them. Inasmuch as no national system has yet been developed under which the reporting of all morbid conditions to the health agency is automatically ensured, attempts are made either to interpret data of a rather selective nature from various medical and health institutions or to undertake enquiries by the household interview method. In these processes of data collection, some new subjects for special consideration are accidental injuries, physical impairments, dental diseases, etc. But the assessment of the total level of morbidity is of primary importance. Studies of special diseases can be part of the same effort. In this chapter some of the developments in the measurement of general morbidity are therefore described.

Alluding to the problems posed by morbidity statistics, the WHO Expert Committee on Health Statistics has stressed the need for understanding the meaning of the terms used. For instance, when we speak of statistics of morbidity, do we mean the persons who are ill, or the diseases they suffer from? Again, illness in a person during a specified period may mean either the number (one or more) of separate attacks of the same disease (colds for instance) or all attacks of all the diseases. Attacks of two or more diseases may run concurrently.

Sometimes we are not able to observe a population continuously and may merely take a "snapshot", i.e. ascertain the picture on a single day. Any indices computed from morbidity data should clearly distinguish between results of observations over a period and a single-day snapshot. Even more important is the consideration that several circumstances determine the recognition or recording of the illness. For instance, did the person contribute to illness records in connexion with a special enquiry or did he appear on his own? In the latter case the greater the advantages the ill person derives from making the report, the larger may be the proportion of ill persons accounted for. Some illnesses may be so trivial as not to cause any disability whatever; some may cause only minor restriction of ordinary activities, and others may lead to absence from work, confinement to bed, or to hospital. These special aspects of illness should be taken into account in the measurement of morbidity.

While we need counts of total illnesses of persons ill, we also need indices to compare their duration, severity, recurrence, and so on. We also require a clear understanding of certain terms such as "illness", "new illness", "recurrent illness", "continued illness", "minor ailment", "injury", "duration of sickness", "number of persons exposed to risk", etc.

Morbidity statistics present many facets, each requiring a suitable numerical measure. A masterly exposition of this has been made by Copes.[1]

17.2 Definitions of morbidity

The term "morbidity" itself can hardly have a single meaning as it depends on the source of the data or the purpose for which they are sought. The term "disease", even if applied restrictively to one disease entity, would also vary in its connotation, according to the source of information or the purpose of study. Some measure of agreement has already been reached for a few terms described in this chapter. But the inherent dependence of the definition of each term on the sources or uses of statistics concerned should always be kept in mind. These are:

(1) hospital or dispensary statistics, (2) general practitioners' records, (3) morbidity data derived from sickness surveys, (4) industrial absenteeism morbidity, (5) social security morbidity, (6) notifiable disease, and (7) statistics derived from registration of certain diseases such as cancer, tuberculosis, venereal diseases, and mental diseases.

17.2.1 *Definitions used in general surveys of sickness (household interview surveys)*

The concensus of opinion is that the terms "illness", "sickness" and "morbid condition" are synonymous, each denoting "any departure, subjective or objective, from a state of physiological wellbeing resulting from disease, injury, or impairment." Of course these terms, would in general cover varying degrees of severity but for statistical purposes it would be

[1] The statistical measurement of morbidity frequency, by P. Copes, Health and Welfare Division of the Dominion Bureau of Statistics, Canada, 1957.

desirable to exclude the most trivial ones. The definition used by the current US National Health Survey by household interview and usually based on subjective rather than objective criteria, is:

> Morbidity is basically a departure from a state of physical or mental wellbeing, resulting from disease or injury, of which the affected individual is aware. It includes not only active or progressive disease but also impairments, that is, chronic or permanent defects that are static in nature, resulting from disease, injury, or congenital malformation. The existence of morbidity in an individual caused by a particular disease, injury, or impairment is called a "morbidity condition" or simply a "condition".[1]

In the morbidity inquiries in England and Wales, and in Denmark, an "illness" was defined as a condition which caused some disability during the period, disability being interpreted as meaning that the subject was "suffering from" it or was aware of its existence as something disturbing his state of health during the period. In the Canadian Sickness Survey an illness was defined as "a disturbance in the state of health of an individual reported by the informant in the form of a diagnosis, a group of related symptoms or a single symptom". For purposes of the Survey, illnesses included injuries and confinements as well as diagnoses of disease and undiagnosed symptoms. In the National Health Survey of Japan, an illness was defined as an unusual condition of body or mentality:
(1) which is treated by a physician, dentist, or some other therapeutist, or treated with medicines, drugs or some other medical materials; or when (1) is not applicable, (2) which caused a stay in bed or inability to work for more than a day. However, the following cases were excluded: (1) normal pregnancy, delivery, puerperium and menstruation; (2) handicapped conditions (blindness, deafness, dumbness, impairment of trunk or extremities and disturbance of central nervous system) with symptoms stabilized and fixed; (3) myopia, hypermetropia and astigmatism.

The term "disease" denotes a disturbance in physical or mental health. This disturbance may not be apparent but discovered only after special investigation (serology, radiology, histology, etc.).

"Injury" is a condition produced by an external cause such as violence, accident, poisoning, or misadventure in applying a diagnostic procedure and included in codes 800-999 of the International Statistical Classification of Diseases, Injuries and Causes of Death, 1957.

17.2.2 *Qualifying terms for illness reported in sickness surveys*

New or continued:

New illness — illness commencing during a defined period.

Continued illness — illness that commenced before the defined period and continued into it.

[1] Health Statistics from the U.S. National Health Survey. Concepts and definitions in the health household-interview survey. Series A-3. U.S. Department of Health, Education and Welfare, Public Health Service, 1958.

Acute or chronic:

The distinction between acute and chronic is in practice based on a variety of criteria such as medical indications, severity, duration etc. The sense in which the terms are used should be made clear in the context of each particular study.

Disabling or non-disabling illness: Incapacitating or non-incapacitating illness:

Disabling or incapacitating illness: illness causing any degree of interference with the ability of the patient to continue his ordinary activities.

Non-disabling or non-incapacitating illness: illness causing no disability (incapacity) throughout that portion of its duration which fell within the defined period.

Disabling or incapacitating illness can be further subdivided, for example as follows:

minor restriction of activities,
absence from work or school,
confinement to bed,
admission to hospital.

These categories are not mutually exclusive.

Another way of classifying illness would be according to recourse to medical advice and/or treatment.

Illness can of course be qualified on the basis of the reported diagnosis. In this connexion an "ill-defined" illness is a symptomatic or undiagnosed complaint included in codes 773, 780-795 of the International Classification.

A "minor illness" would be an illness, not ill-defined, which does not customarily keep the person in bed (at ages under 65 years) for as much as one day. On the other hand a "major illness" would be one which is neither "minor" nor "ill-defined".

"Recurring illness" connotes repeated attacks, generally of longterm conditions, counted as an illness if there is an interval of eight days or more free of symptoms relating to the condition since the previous attack.

17.3 Basic concepts in morbidity measurement

Certain concepts in morbidity measurement are common to all the morbid states referred to in section 17.2, only requiring a modification in the basic terminology. Some definitions of terms are no doubt determined by administrative, legal or medical requirements. Nevertheless three units in morbidity measurement are important, viz. (1) persons ill, (2) the illnesses experienced, and (3) the duration of these illnesses. The meaning of the terms "illness" or "periods of illness" or "spell" will be determined by circumstances: for instance, hospital in-patients contribute to statistics of periods of hospitalized illness only. As already explained in section 6.4.2, for statistical purposes distinction is made between (a) illnesses beginning during a defined period, (b) illnesses current either during a defined period or at a particular point of time within the period, or at an average point of time within the period, and (c) the duration of these illnesses.

17.3.1 *Frequency of illnesses commencing during a defined period*

The illnesses which started before the period and continued into it are excluded. The illnesses commencing within the defined period or persons becoming ill during the period are counted. The WHO Expert Committee on Health Statistics has recommended that the term "incidence" be used to describe the measurement of frequency of illnesses commencing during a defined period. In utilizing the term "incidence" it should be made clear whether the term is used in respect of illnesses or in respect of persons ill. In calculating the incidence rate the denominator should be the average number of persons exposed to risk during the defined period or the estimated number of persons at the mid-point of that period.

17.3.2 *Frequency of illnesses in existence at any time during a defined period*

This measurement includes all illnesses that are current at any time during a defined period whether they started before or during the period. The measurement is also applied to persons ill at any time during the period whether they became ill before or during the period. This measurement is designated "period prevalence" (weekly, monthly or annual) with the further indication as to whether the measurement related to illnesses or to persons. In the calculation of period prevalence rate the denominator is the same as for the incidence rate (see Section 17.3.1).

17.3.3 *Frequency of illnesses in existence at a particular point of time*

This measurement relates to illnesses (or persons ill) current at a given time (e.g. the first day, the last day, a daily average within a defined period), regardless of when the illness commenced. This measurement is designated "*point prevalence*" or more specifically the prevalence at a stated point in time. In ascertaining point prevalence rate the denominator is the number, actual or estimated, of persons at risk at the given time.

17.3.4 *Duration of illness*

Duration of illness is measured either by period of average duration or by the frequency distributions of durations, i.e. a tabular arrangement showing how frequently various periods of duration are recorded. In measuring duration, the date of onset and the date of recovery from illness are defined on the basis of uniformly applied criteria depending on the type of morbidity statistics under consideration. As stated by the Expert Committee on Health Statistics[1], "these two forms of statistical measurement can be computed for:

(a) the population at risk, yielding an average duration of illness and a frequency distribution of durations of illness in the population at risk during a defined period (e.g., days of illness per person of the population);

(b) ill persons, yielding an average total duration of illness and a fre-

[1] WHO Expert Committee on Health Statistics, Sixth Report. Technical Report Series 164, Geneva, 1959.

quency distribution of durations of illness amongst persons who were ill during a defined period (e.g., total days of illness per person ill);

(c) periods (spells) of illness, yielding an average duration of periods of illness and a frequency distribution of durations of periods of illness during a defined period (e.g., total days of illness per period of illness)."

17.4 Morbidity rates

The following definitions in summary form are based on proposals made by the Statistics Subcommittee of the Registrar General's Advisory Committee on Medical Nomenclature and Statistics (General Register Office of England and Wales):

1. *Rate of Inception of spells* of sickness: The number of spells of sickness which start during a defined period divided by the average number of persons exposed to risk during that period.
   Short title: Inception rate or incidence rate (spells).
   A "spell of sickness" is a period during which a person is sick on one day (or shift) or on each day of a consecutive series of days (or shifts).
2. *Proportion of persons who start a spell* of sickness during a period.
   The number of persons who start at least one spell of sickness during a defined period divided by the average number of persons exposed to risk during that period.
   Short title: Inception rate or incidence rate (persons).

3(*a*). *Rate of Prevalence of spells* of sickness in a period.
   The number of spells of sickness which are current at some time during a defined period divided by the average number of persons exposed to risk during that period.
   Short title: Period Prevalence rate (spells).

3(*b*). *Rate of Prevalence of spells* of sickness at a point of time.
   The number of spells of sickness which are current at a given time divided by the number of persons exposed to risk at that time.
   Short title: Point Prevalence rate (spells).

4(*a*). *Proportion of persons sick in a period*
   The number of persons who are sick sometime during a defined period divided by the average number of persons exposed to risk during that period.
   Short title: Period Prevalence rate (persons).

4(*b*). *Proportion of persons sick at a point of time*
   The number of persons who are sick at a given time divided by the number of persons exposed to risk at that time.
   Short title: Point Prevalence rate (persons).

5. *The average Duration of sickness per completed spell*
   The total of the entire durations of all spells of sickness ending during a defined period divided by the number of spells ending during that period.
   Short title: Average duration per spell.

6. *The average Duration of sickness per sick person*
   The total of the entire durations of all spells of sickness ending during a defined period divided by the number of persons who experienced at least one spell ending during that period.
   Short title: Average duration per sick person.

7. *The average Duration of sickness per person*
   The total duration within a defined period of all spells of sickness that occurred wholly or partly within that period divided by the average number of persons exposed to risk during the period.
   Short title: Average duration per person.
8. *The proportion of time sick*
   The total duration within a defined period of all spells of sickness that occurred wholly or partly within that period divided by the total duration of exposure to risk in the period.
   Short title: Proportion of time lost.
9. *Fatality ratio*
   The number of deaths from a disease recorded during a defined period divided by the number of new cases of that disease recorded during the same period (or related period).
   Short title: Fatality ratio.

Several other measures of morbidity used in connexion with health surveys are described in "Health in California" published by the Department of Public Health, State of California, Berkeley, USA, 1957.

17.5 Analysis of communicable disease statistics

17.5.1 *Definitions*

A communicable disease is defined[1] as an illness due to an infectious agent or its toxic products which is transmitted directly or indirectly to a well person from an infected person or animal, or through the agency of an intermediate animal host, vector, or the inanimate environment. This includes infestations by ectoparasites such as pediculosis.

An epidemic or outbreak is the occurrence in a community or region of a group of illnesses of similar nature, clearly in excess of normal expectancy, and derived from a common or propagated source. The number of cases indicating presence of an epidemic varies according to the causal agent, size and type of population exposed, previous experience or lack of exposure to the disease, and time and place of occurrence. Epidemicity is thus relative to usual frequency of the disease in the same area, among the specified population, at the same season of the year. A single case of a communicable disease long absent from a population or first invasion by a disease not previously recognized in that area is to be considered as a potential epidemic.

The "number of persons exposed to risk" at a given time includes all those who would, in the event of their becoming sick, be recorded as sick in the context of the particular enquiry; it should exclude any others.

The "carrier" is an individual who harbours and transmits pathogenic parasites without showing the usual evidence of infection (and sometimes without clinical or pathological evidence at all).

A "suspect" is a person whose medical history and symptoms suggest

[1] Some of these definitions are taken from: "Control of Communicable Diseases in Man", American Public Health Association, New York, 1955.

that he may have or be developing some communicable disease. He may also be termed "a suspected case".

"Suffering from": A simple and practical interpretation of the term "suffering from" for purposes of notification is that the patient should show definite clinical manifestations of the disease. The term does not include indefinite sub-clinical cases or cases in which evidence of infection is forthcoming only from bacteriological, radiological or serological findings in the absence of clinically discernible effects.

"Official Report" of a disease is notification of the occurrence of a communicable or other disease in man or animals to the local health authority for diseases of man, to the livestock, sanitary or agriculture authority for disease of animals, and in some instances, disease of both animal and man to the health authority. The report includes suspected cases of diseases of particular public health importance, ordinarily those requiring epidemiologic investigation or initiation of special control measures.

When a person is infected in one health jurisdiction and the case is reported from another, the authority receiving the report notifies the other jurisdiction involved, especially if the disease is such as to require examination of contacts for infection, or of food or water supplies as vehicles.

A distinction should be drawn between "provisional notifications" and "corrected notifications", the latter term relating to cases in which the diagnosis has been subsequently confirmed. In publishing notifiable disease statistics the estimated degree of error arising from incompleteness of notification should be indicated. In respect of certain notifiable diseases such as tuberculosis, distinction should be made, if possible, between "new cases" and "newly detected pre-existing cases".

17.5.2 *Rates used for notifiable disease statistics*

The basic measurements used in general morbidity statistics are directly applicable, (see Section 17.3). For instance, "notification rate" as defined below corresponds with incidence rate of illness or of ill persons. Thus:

Notification rate. This is the number of notifications during a defined period divided by the average number of persons exposed to risk during the period.

Carrier rate. The proportion (per 100, per 1000, etc.) of carriers found in apparently normal individuals.

Secondary attack rate. This is a measure of the risk of persons in a household exposed to a disease in another member (index case) in the same household, thus showing the increased risk of contracting the disease due to familial exposure. The number of new cases in the households is expressed as a percentage of the total number in the households, excluding the index cases.

17.6 Definitions of terms used in hospital statistics

Even if information through household interview survey methods is not obtainable, statistics from hospitals and dispensaries can provide valuable information provided they are interpreted with due regard to the selective nature of these data. In any case these statistics do show the kinds of diseases or injuries for which medical facilities are being sought, as well as seasonal and annual variation in the diseases as reflected by changes in admissions or attendances. Serious consideration has been given in the United States, the United Kingdom, France and other countries to defining various terms which frequently appear in hospital statistics.[1] The subject has also been discussed by the WHO Expert Committee on Health Statistics. In addition, the United Nations Trusteeship Council has attempted to standardize some terms for use in non-self-governing territories. Although no single definition of many of the terms appears to have been agreed upon, those so far used or formulated are in close accord. The difference in the quality or progress of medical services is so marked that sometimes even the best hospital in one area may not compare favourably with one regarded as poor in an advanced country, and so mere adherence to terminology cannot provide strictly comparable data. Many figures published by UN and WHO contain clear reservations to this effect. The important point is that the terminology used in publishing statistics should mean the same thing to the reader as to the writer of the report. Only after some of the definitions given below have been put into use and tested, can a common language evolve and further improvement be made. At this stage, we have to recognize the need for explaining by clear statements to the users of information what each term really signifies. Some of the suggested definitions are:

A "hospital" is an establishment where the sick and injured are admitted, examined and treated, when necessary. This establishment may also admit for observation subjects suspected of being ill, injured, or carrying germs. An establishment receiving exclusively invalids, infirm persons, old people who are not ill, convalescents and women in childbirth should not be considered as a hospital.

Hospitals are classified as "general" or "special", a general hospital accommodating and treating all types of patients, while a special hospital takes those whose state calls for diagnosis or treatment adapted to their disease, to affections of physical or mental system, or to their age. In some cases a hospital is classed as special if 90 per cent or more beds are allocated to a particular speciality, (e.g. infectious diseases), or a hospital organized for the treatment of patients suffering from psychiatric conditions (mental hospital).

The term "hospital" is distinguished from a dispensary or polyclinic, the latter being a medical establishment where patients may attend for

[1] Handbook on Accounting, Statistics and Business Office Procedures for Hospitals. American Hospital Association, 1950.

Mental Statistics Handbook. Dominion Bureau of Statistics, Ottawa.

Handbook of Definitions and Instructions for Completing Hospital Reporting Schedules. Dominion Bureau of Statistics, Ottawa, 1955.

consultation and treatment not requiring hospital admission. It may either be exclusively for out-patients, or have beds for lighter cases or patients referred for diagnosis but not for treatment.

A "rural health unit", however, is an organization providing or making accessible, under the direct supervision of at least one physician, the basic health services for a community.

An "out-patient clinic" or department is an institution or agency which cares for the ambulatory patient who comes for diagnosis, treatment and follow-up care. It is usually associated with a hospital or in-patient establishment, and patients may be referred between the two institutions.

A "hospital bed" represents the general facilities afforded by staff, premises, equipment and material necessary for the hospital care of a patient.

A "patient" is a person, whether ill or not, who is under the care of a physician acting in his professional capacity. The term is further characterized by hospital patient, in-patient or out-patient. The hospital patient or in-patient is one looked after by a hospital, who has gone through the full admission procedure and is occupying bed space. Practice differs in regard to healthy infants born in hospital; not all hospitals count them as in-patients. Therefore, in stating the number of hospital in-patients, the number of newborn healthy infants should be shown separately. An out-patient is not defined with respect to a hospital, but as a patient whose state does not necessitate occupying a regular hospital bed and who can be treated in the physician's surgery, as well as in a hospital, clinic or dispensary.

"Admission" is the acceptance of an in-patient by a hospital.

"Readmission" is admission of a person for a particular affection or a complication of it, for which he was previously admitted to the same hospital.

"Discharge" is the conclusion of a period of in-patient care in the hospital concerned whether the patient returned to his home, was transferred to another hospital or institution, or died.

A "patient-day" is that period of service rendered to an in-patient between the census-taking hours on two successive days, the day of discharge being excluded. When a patient is admitted and discharged on the same day, it is counted as one patient-day.

The number of newborn infant patient-days are always stated separately.

17.7 Hospital statistics indices

Several indices to describe hospital services are used. Some in common use are defined below. Many rates calculated from hospital statistics also are based on the concept of incidence or prevalence. For instance:

"Admission rate" corresponds with incidence rate. If possible the admission rate should be subdivided into first admissions and readmissions. Figures for discharges rather than admissions are often used as a basis for tabulation, the admission rate and the discharge rate being largely interchangeable.

The "average daily bed occupancy" or "average daily census", is the average number of patients in a hospital and corresponds with the point preva-

lence rate. It is calculated by dividing the number of patient-days during a period by the number of days in the period.

The "average duration of stay" and the frequency distribution of durations of stay are usually tabulated in relation to individual periods of hospitalization. They could equally well be tabulated in relation to the total hospitalization time of persons during a defined period.

Average duration of stay: total duration of stay of discharged patients divided by the number discharged during a period.

Percentage of occupancy: ratio of actual patient-days to the maximum patient days (based on bed-complement) during any given period of time.

Fatality ratio: the number of deaths from a disease occurring in hospital during a defined period, divided by the number of new cases of that disease admitted to that hospital during the same period.

$$\textit{Hospital death rate}: \frac{\text{Total number of hospital deaths in given period}}{\text{Discharges during period}} \times 1000$$

Autopsy rate: the ratio during any given period of all hospital autopsies to all hospital deaths.

17.8 Industrial sick absence statistics

The methods of measuring industrial sick absence have been described in detail in the Report of the International Conference of Sick Absence Statistics (Leyden, October 1957). The measurements recommended in this report are based on and follow closely in terminology the basic measurements of incidence, prevalence and duration given in this chapter.

CHAPTER 18

Life Tables and Follow-up Studies

18.1 Use of life table

For public health purposes, the force of mortality in a population is usually measured by means of such indices as crude death rate, infant mortality rate, specific death rates at different ages by sex, or the standardized death rate. Another effective and at the same time comprehensive method of describing mortality in a population is by means of life tables. A life table is composed of several sets of values showing how a group of infants, all supposed to be born at the same time and experiencing unchanging mortality conditions, would gradually die out. The original purpose of a life table was mainly to provide basis for actuarial computations, but its usefulness in many other fields of study was soon recognized. William Farr called the life table the "Biometer" of the population. Today it is widely accepted as important basic material in demographic and public health studies. Furthermore it provides insurance companies with a firm foundation, converting their business from a mere gambling in human lives to the ability to offer well calculated financial safeguards in the event of death. The economic soundness of this scientific approach is testified by the gigantic buildings owned by insurance companies all over the globe.

Life tables are usually worked out after each decennial census to represent mortality conditions either during the previous decennium or during shorter periods covering the date of the census. Separate tables for males and females are usually prepared. For detailed study it is not uncommon to construct tables for each geographical subdivision of a country or different population segments such as ethnic or occupational groups. A life table can also be constructed to show how a group of babies would die if, hypothetically, one or more causes of death were eliminated. In recent years life table techniques are being increasingly applied to follow-up studies of chronic diseases or hospital patients.

18.2 Structure of a life table

Two indices included in the life table and most frequently used in public health studies, are the life table mortality rate, usually denoted by the symbol q_x, and the expectation of life, usually denoted by the symbol e^o_x. The mortality rate q_x describes the probability of dying within a designated interval of time for persons of any exact age x. The expectation of life e^o_x measures the average number of years a person of a given age x can be expected to live under the prevailing mortality conditions. It is an index showing in summary form the effect of mortality on survival.

MAORI LIFE TABLE, 1950-1952 MALES

Age	Out of 100,000 Boys Born		Probability that a person who reaches this age:		Expectation of life at this age:	Age	Out of 100,000 Boys Born		Probability that a person who reaches this age:		Expectation of life at this age:
	No. who live to this age: l_x	No. who die during this year of age: d_x	lives a further year: p_x	dies within a year: q_x	$\overset{o}{e}_x$		No. who live to this age: l_x	No. who die during this year of age: d_x	lives a further year: p_x	dies within a year: q_x	$\overset{o}{e}_x$
(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
0	100,000	7,976	.92024	.07976	54.05	55	61,116	1,560	.97447	.02553	15.67
1	92,024	1,609	.98252	.01748	57.69	56	59,556	1,622	.97277	.02723	15.07
2	90,415	498	.99449	.00551	57.71	57	57,934	1,699	.97068	.02932	14.47
3	89,917	358	.99602	.00398	57.02	58	56,235	1,800	.96799	.03201	13.90
4	89,559	271	.99697	.00303	56.25	59	54,435	1,917	.96478	.03522	13.34
5	89,288	218	.99756	.00244	55.42	60	52,518	2,031	.96132	.03868	12.81
6	89,070	191	.99786	.00214	54.55	61	50,487	2,127	.95788	.04212	12.30
7	88,879	180	.99797	.00203	53.67	62	48,360	2,188	.95476	.04524	11.82
8	88,699	182	.99795	.00205	52.78	63	46,172	2,228	.95174	.04826	11.36
9	88,517	178	.99799	.00201	51.89	64	43,944	2,251	.94878	.05122	10.91
10	88,339	155	.99825	.00175	50.99	65	41,693	2,258	.94584	.05416	10.47
11	88,184	131	.99852	.00148	50.08	66	39,435	2,254	.94284	.05716	10.04
12	88,053	128	.99855	.00145	49.15	67	37,181	2,241	.93973	.06027	9.62
13	87,925	149	.99831	.00169	48.22	68	34,940	2,221	.93644	.06356	9.21
14	87,776	187	.99787	.00213	47.30	69	32,719	2,195	.93290	.06710	8.80
15	87,589	234	.99733	.00267	46.40	70	30,524	2,165	.92906	.07094	8.39
16	87,355	283	.99676	.00324	45.53	71	28,359	2,131	.92486	.07514	8.00

24	84,233	455	.99460	.00540	
25	83,778	447	.99466	.00534	38.26
26	83,331	442	.99469	.00531	37.46
27	82,889	443	.99465	.00535	36.66
28	82,446	451	.99453	.00547	35.86
29	81,995	462	.99436	.00564	35.05
30	81,533	476	.99416	.00584	34.25
31	81,057	492	.99393	.00607	33.44
32	80,565	510	.99367	.00633	32.65
33	80,055	532	.99336	.00664	31.85
34	79,523	557	.99299	.00701	31.06
35	78,966	584	.99261	.00739	30.28
36	78,382	608	.99224	.00776	29.50
37	77,774	628	.99192	.00808	28.72
38	77,146	640	.99170	.00830	27.95
39	76,506	646	.99156	.00844	27.18
40	75,860	651	.99142	.00858	26.41
41	75,209	661	.99121	.00879	25.64
42	74,548	681	.99087	.00913	24.86
43	73,867	707	.99043	.00957	24.08
44	73,160	736	.98994	.01006	23.31
45	72,424	773	.98933	.01067	22.54
46	71,651	820	.98855	.01145	21.78
47	70,831	883	.98753	.01247	21.03
48	69,948	967	.98617	.01383	20.29
49	68,981	1,069	.98450	.01550	19.56
50	67,912	1,178	.98265	.01735	18.86
51	66,734	1,285	.98075	.01925	18.19
52	65,449	1,377	.97896	.02104	17.53
53	64,072	1,449	.97739	.02261	16.90
54	62,623	1,507	.97594	.02406	16.28
80	11,061	1,547	.86013	.13987	4.79
81	9,514	1,439	.84880	.15120	4.49
82	8,075	1,321	.83642	.16358	4.20
83	6,754	1,196	.82292	.17708	3.92
84	5,558	1,066	.80824	.19176	3.66
85	4,492	933	.79230	.20770	3.41
86	3,559	801	.77506	.22494	3.17
87	2,758	672	.75645	.24355	2.95
88	2,086	550	.73641	.26359	2.74
89	1,536	438	.71488	.28512	2.54
90	1,098	338.4	.69178	.30822	2.35
91	759.6	252.9	.66706	.33294	2.17
92	506.7	182.1	.64066	.35934	2.01
93	324.6	125.8	.61251	.38749	1.85
94	198.8	83.0	.58256	.41744	1.71
95	115.8	52.0	.55073	.44927	1.57
96	63.8	30.8	.51696	.48304	1.44
97	33.0	17.1	.48120	.51880	1.32
98	15.9	8.9	.44338	.55662	1.21
99	7.0	4.2	.40344	.59656	1.11
100	2.8	1.8	.36131	.63869	1.01
101	1.0	.7	.31693	.68307	.93
102	.3	.2	.27024	.72976	.84
103	.1	.1	.22118	.77882	.76
104	.	.	.16968	.83032	.24
105	.	.	.11568	.88432	.62
106	.	.	.05912	.94088	.56

18.3 Construction of a life table

It is usual to construct a life table showing survival and death occurring in a generation of 100,000 babies. We ask what would happen if these 100,000 babies born at the same time were subjected to those mortality influences at various ages that are found to be influencing the population at a certain period of time. How many of these 100,000 would live to see their first birthday; how many their second birthday; how many their third birthday, and so on, till the last one? On the basis of the mortality rate operating at the time under study, we can estimate what number would be alive at the first birthday by applying the mortality rate during the first year on the 100,000 children. By the application of the mortality rate of the second year on the number surviving at the end of the first year, we estimate the number who would survive to the end of the second year of life. Similarly for other ages. These numbers of survival to various ages form the basic data set out in a life table. From these we can also calculate the average lifetime a person can expect to live after any age.

As an example, the life table for the Maori male population of New Zealand for 1950-52 is given with an explanation of the table headings:

Age x (column 1): The ages shown in this column refer to the exact age denoted by x.

Life table survivors l_x (column 2): The figures in this column show the number of persons surviving to successive ages. For example, out of 100,000 babies born the number of survivors at age 1 year is 92,024 and at 2 years of age 90,415, etc.

Life table deaths d_x (column 3): The numbers in this column are the differences between two consecutive numbers of the previous l_x column. For example, in the first year of life 7,976 babies died which when subtracted from 100,000 gives the figure 92,024 survivors at 1 year of age.

Survival rate p_x (column 4): The survival rate in this column represents the probability of survival for one year after attaining age x.

Mortality rate q_x (column 5): This rate shows the probability of dying within one year for a person attaining exact age x. It is equal to $1-p_x$. It should be noted that this mortality is not the same as the age-specific death rates (denoted by m_x) obtained from death registration records (see Section 16.2). For the life table death rate the denominator is the number of people alive at exact age x and the numerator the number dying between ages x and $x + 1$.

Expectation of life, e^o_x (column 6): This shows the average number of years of future life of persons of any age on the assumption that they will experience the mortality rates exhibited in the life table. Thus the first figure, 54.05, means that on an average a male child at birth can be expected to live for a period of 54.05 years. The second figure in the same column, viz. 57.69, means that a child who attains one year of age can expect on an average to live for a further period of 57.69 years. Similarly, a male child who completes his second year of life will have on an average a further period of 57.71 years.

Expectation of life is a useful index to summarize the mortality experience in the lifetime of a population and is therefore used for comparing the health conditions of different population groups. The previous table gives figures of expectation of life at birth for 21 countries for recent years.

Expectation of life at specified ages by sex for 21 *countries*

Continent, country, period	Sex	Expectation of life in years at age					60
		0	1	5	15	30	
AFRICA							
Belgian Congo	M	37.64	42.45	44.04	37.78	27.69	10.63
African population, 950-52	F	40.00	44.14	45.87	39.58	29.78	12.27
Egypt, 1936-38	M	35.65	42.09	49.75	43.53	32.96	13.29
	F	41.48	48.14	58.33	50.11	38.23	16.26
Union of South Africa	M	50.70	54.29	53.05	44.29	32.72	11.97
Asiatic population, 1945-47	F	49.75	52.82	51.62	43.08	32.12	11.96
AMERICA, NORTH							
Mexico, 1940	M	37.92	44.43	48.55	41.34	31.00	13.35
	F	39.79	46.22	50.90	43.75	33.31	13.54
United States	M	67.3	68.2	64.5	54.8	40.9	16.0
White population, 1955	F	73.6	74.2	70.4	60.7	46.2	19.3
AMERICA, SOUTH							
Brazil	M	49.80	54.65	53.87	44.82	32.82	12.80
Federal District, 1949-51	F	55.96	60.35	59.98	50.88	39.01	16.60
Chile, 1952	M	49.84	56.83	55.64	46.90	34.79	13.99
	F	53.89	60.62	59.95	51.23	39.25	16.42
ASIA							
Ceylon, 1954	M	60.3	64.3	64.2	55.6	41.9	16.6
	F	59.4	62.7	63.0	54.8	42.0	16.8
China, Taiwan, 1936-41	M	41.08	47.61	49.48	41.23	29.68	11.28
	F	45.73	51.46	54.56	46.44	34.83	14.18
India, 1941-50	M	32.45	39.00	40.86	36.24	26.58	10.13
	F	31.66	37.30	40.91	36.56	26.18	11.33
Japan, 1955	M	63.88	65.64	62.73	53.40	40.00	15.33
	F	68.41	69.99	67.09	57.66	44.01	18.59
Korea, 1938	M	47.20	51.11	53.42	45.68	33.83	12.84
	F	50.59	54.47	56.71	48.95	37.65	14.83
Thailand, 1947-48	M	48.69	52.00	51.27	43.81	32.53	12.69
	F	51.90	55.20	54.30	46.80	35.44	14.20
EUROPE							
France, 1950-51	M	63.6	66.1	62.7	53.1	39.3	15.1
	F	69.3	71.2	67.8	58.2	44.1	18.1
West Germany, 1949-51	M	64.6	67.8	64.5	55.0	41.3	16.2
	F	68.5	71.0	67.6	58.0	43.9	17.5
Netherlands, 1953-55	M	71.0	71.8	68.2	58.5	44.2	17.8
	F	73.9	74.3	70.6	60.8	46.2	18.9
Spain, 1950	M	58.76	63.12	60.99	51.92	39.10	15.18
	F	63.50	67.63	65.59	56.51	43.34	17.69
England & Wales, 1953-55	M	67.46	68.46	64.77	55.05	40.81	15.04
	F	72.86	73.52	69.80	60.03	45.52	18.67
OCEANIA							
Australia, 1946-48	M	66.07	67.25	63.77	54.28	40.40	15.36
	F	70.63	71.45	67.91	58.27	44.08	18.11
New Zealand, 1950-52	M	68.29	69.03	65.39	55.79	41.89	16.19
European population	F	72.43	72.90	69.23	59.47	45.06	18.53
Maori population	M	54.05	57.69	55.42	46.40	34.25	12.81
	F	55.88	59.08	56.61	47.59	35.11	14.41

The table below shows the increase in longevity that has taken place from around 1900 in about half a century in some of the countries for which comparable figures are available.

Male expectation of life at birth and at age 60 for certain countries during about fifty year period prior to 1950

Continent and country	Period	Expectation of life	
		at birth	at age 60 years
AMERICA, NORTH			
United States	1900-02	47.88	14.33
	1929-31	57.71	14.62
	1955	67.3	16.0
Trinidad and Tobago	1900-03	36.73	10.62
	1930-32	44.51	10.78
	1954-56	59.81	13.53
AMERICA, SOUTH			
Chile	1930	35.4	13.7
	1952	49.84	13.99
British Guiana	1910-12	29.9	9.3
	1930-31	40.3	9.7
	1945-47	49.32	11.13
ASIA			
India	1901-11	22.59	10.00
	1921-31	26.91	10.25
	1941-50	32.45	10.13
Japan	1899-1903	43.97	12.76
	1926-30	44.82	12.23
	1955	63.88	15.33
EUROPE			
England and Wales	1891-1900	44.13	12.93
	1930-32	58.74	14.43
	1953-55	67.46	15.04
France	1898-1903	45.31	13.31
	1928-1933	54.30	13.76
	1950-51	63.6	15.1
Netherlands	1900-09	51.0	14.7
	1921-30	61.9	15.9
	1953-55	71.0	17.8
Sweden	1901-10	54.53	16.06
	1921-30	60.97	16.61
	1951-55	70.49	17.38
OCEANIA			
Australia	1901-10	55.20	14.35
	1932-34	63.48	15.57
	1946-48	66.07	15.36
New Zealand	1901-05	58.09	15.40
(excl. Maoris)	1931	65.04	16.22
	1950-52	68.29	16.19

Data for both these tables are derived from United Nations Demographic Year Books for the years 1951 and 1957. Table IX in the Appendix shows figures for the expectation of life at birth from the earliest period available for certain countries.

18.4 Study of the life table

To a public health worker the study of the different columns in the life table affords a means of comparing mortality conditions of different groups

of populations or of the same population at different ages and epochs. In Figure 18.4 for instance, a comparison is made of the male survivors in Sweden at the middle of the last and the present century. More generally, it describes an important biological feature of the group, its mortality history from beginning to end. The idea underlying a life table can be, and indeed has been, extended to study the life history of other living organisms. A. Bradford Hill's book "Principles of Medical Statistics" discusses measurement of survival rates after treatment and the construction of a survivorship table. The life table technique can also be utilized in the study of diseases, particularly chronic diseases; for example, in measuring the risk of certain infectious diseases like leprosy, tuberculosis, etc. caused by a long household contact and in comparing the efficacy of different kinds of treatment of these diseases.

Life tables are also used in the study of a number of social and economic problems. The method of calculating premiums for life insurance policies is based on the principle that when a group of persons purchases the same kind of endowment policy, the total value at the time of purchase of all the net premiums to be paid, must cover the value of the benefits to be received. The number of premiums a person is likely to pay will naturally depend on the length of his life. Another application of life table techniques in economic affairs is the estimation of compensation for injury or death in an industry for which exact knowledge of the money value of man would be required.

To the student of population, life tables are a valuable instrument. They enable him to study population growth and to forecast the size and distribution of populations at a future date, under certain assumptions. With the help of a life table, demographers have devised measures such as "net reproduction" rate to describe the true rate at which a population is increasing. Other examples of the uses of life tables are: (1) estimation of the size of a future labour force; (2) forecast of the school-going population in connexion with school building programmes; (3) estimation of the probable number of future orphans in a community; (4) computation of the probable number of future widows; (5) study of trends in age distribution of a population.

18.5 Computation of life table rates

In constructing a life table the first index to be calculated is the mortality rate q_x. From this index the computation of other indices is straightforward. In deriving the mortality rate q_x, however, many difficulties may arise, depending on the availability and quality of the basic vital statistical data. Estimation of the mortality rate is complicated by the fact that the life table mortality rate should represent, as was stated above, the probability of dying within a specified time period for persons who have just reached exact age x. Although the age-specific death rate can be readily computed from the registered vital statistics, it needs careful adjustment to provide the required probability value q_x. To secure such adjustment the construction of detailed national life tables involves a careful simultaneous study of the

LIFE TABLE SURVIVORS OF 10,000 MALES BORN ALIVE, SWEDEN
1816-1840 AND 1951-1955

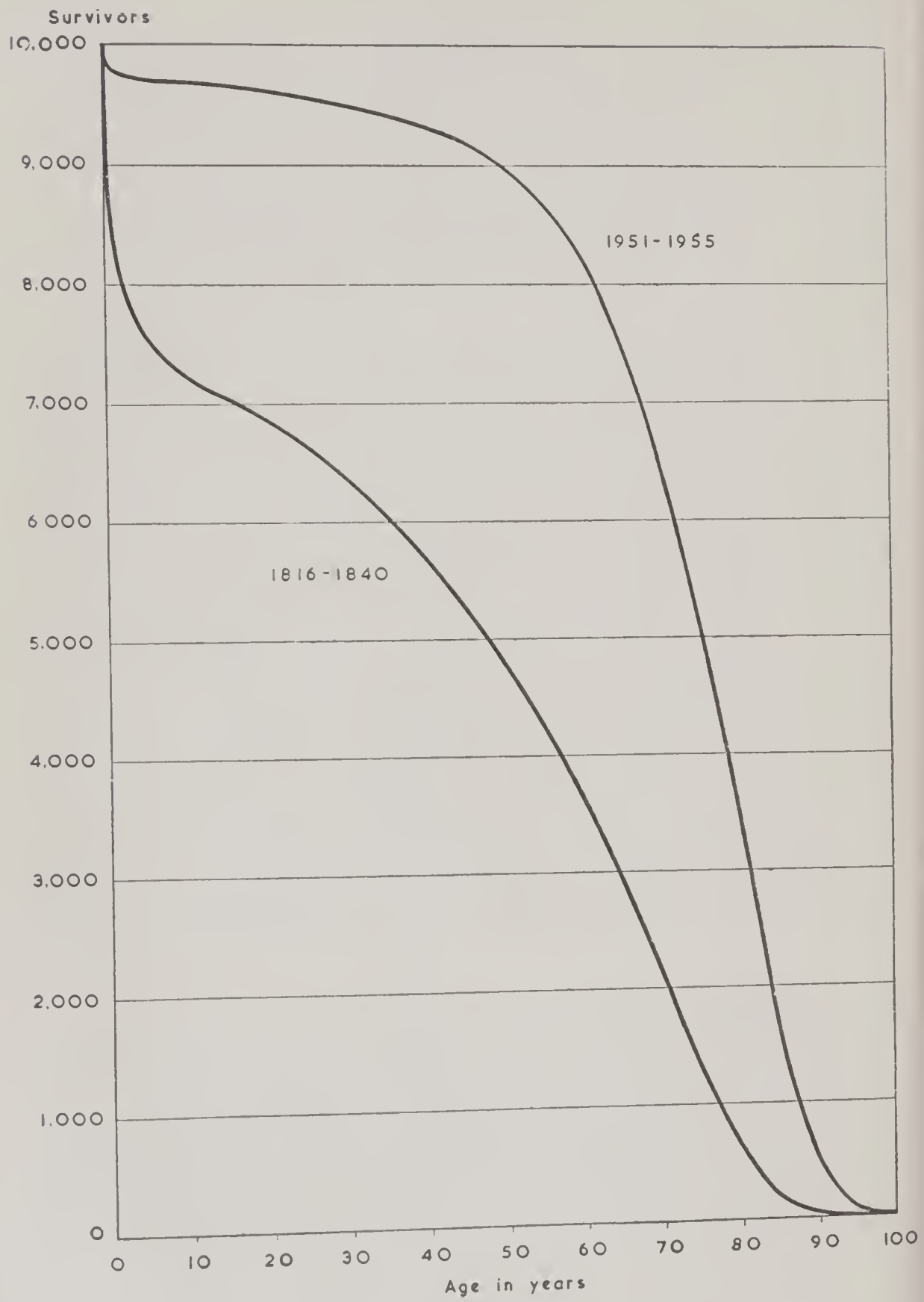


Fig. 18.4

data on population, migration, births and deaths. It is in itself a specialized branch of study, beyond the scope of this book. For a detailed discussion the reader is referred to Mortimer Spiegelman[1], Chapter 5.

18.5.1 *Abridged life table*

Several simple methods to obtain the mortality rate have been devised for constructing abridged life tables which do not require elaborate computing. These methods, though lacking in precision, are useful to health workers for carrying out ready comparisons. The simplest abridged method is to use the age specific death rate m_x itself as a substitute for the life table mortality rate q_x. For the age under 1 year, the life table mortality rate is substituted by the infant mortality rate. A more elaborate method to derive the values of q_x from m_x uses the formula:

$$q_x = \frac{2m_x}{2+m_x},$$

for the life table mortality rate for ages 1 year and above.

Still more refined methods are developed by King,[2] Reed and Merrell,[3] Greville[4] and Kuczynski[5]. If the values of q_x are plotted on a graph with age represented on the abscissa, some irregularity is seen. This is frequently adjusted by fitting a smooth curve. This process is called graduation.

When the values of q_x are obtained, other quantities in the life table are computed as follows. We can obtain the number dying, d_x (see column 3 in the Maori life table) by multiplying the mortality rate q_x (column 5) with the number surviving (column 2). Subtracting d_x from l_x we get l_{x+1}, the number surviving at the next age. This process is continued until l_x becomes negligibly small. For computation of the expectation of life e^o_x, a quantity L_x which represents the number of years lived by the cohort between ages x and x+1 is first worked out by means of a formula:

$$L_x = (l_x + l_{x+1})/2.$$

This formula is rewritten as $L_x = l_{x+1} + d_x/2$. It means that each person surviving to age x+1 contributes 1 year and each person dying between ages x and x+1 contributes on the average 1/2 year to the quantity L_x. Expectation of life is then computed by the formula:

[1] Introduction to Demography, by M. Spiegelman. Society of Actuaries, Chicago, Ill., 1955, USA.

[2] On a short method of constructing an abridged mortality table, by G. King. Journal of the Institute of Actuaries, Vol. 48, p. 294, 1914.

[3] A short method for constructing an abridged life table, by L. J. Reed and M. Merrell. American Journal of Hygiene, Vol. 30, p. 33, 1939.

[4] Short methods of constructing abridged life tables, by T.N.E. Greville. Record of the American Institute of Actuaries, Vol. 32, p. 29, 1943.

[5] The measurement of population growth, methods and results, by R.R. Kuczynski, Sidgwick and Jackson, Ltd, 1935, London, p. 177.

$$e^{o}_{x} = \frac{L_x + L_{x+1} + L_{x+2} + \ldots}{l_x}$$

For ages under 1 year the above formula for L_x does not give an accurate estimate, because deaths under one year are not distributed uniformly over the year. One method of adjustment is to subdivide the first year of age into months and sometimes the first month into even weeks or days, and then to apply a similar formula to compute L_x for the subdivisions, (see Dublin, Lotka and Spiegelman[1] for a fuller discussion).

Abridged life tables are usually prepared, not for each year of age, but for 5-year or 10-year age groups. In such cases, the formula for the mortality rate corresponds to the one quoted above.

$$_{n}q_{x} = \frac{2n\ {}_{n}m_{x}}{2 + n\ {}_{n}m_{x}}$$

where n is the number of years in an age group, for instance 5 in the case where 5-year age groups are studied, $_{n}q_{x}$ is the probability of dying within n years for persons attaining age x, and $_{n}m_{x}$ is the average annual age-specific death rate for the age group x to x+n—1. Other quantities are computed as follows:

Number of deaths between ages x and x+n: $_{n}d_{x} = l_x\ {}_{n}q_{x}$

Number of survivors at age x+n: $l_{x+n} = l_x - {}_{n}d_{x}$

Total number of years lived by the cohort between ages x and x+n i.e., $_{n}L_{x} = {}_{n}d_{x}/{}_{n}m_{x}$

Expectation of life: $e^{o}_{x} = \frac{{}_{n}L_{x} + {}_{n}L_{x+n} + {}_{n}L_{x+2n} + \ldots}{l_x}$

In the following example, an abridged life table is worked out by means of a simple procedure developed by Kuczynski:

1. For the first year of life the survivor figure is to be worked out from the infant mortality rate.

2. The probability of surviving the next four years is obtained from the formula:

$$l_5 = \frac{p_{(1-4)} - d_{(1-4)} \times 1.2}{p_{(1-4)} + d_{(1-4)} \times 2.8} \times l_1$$

where $p_{(1-4)}$ denotes the population of age 1-4 years and $d_{(1-4)}$ the annual deaths at age 1-4 years.

3. The survivors at 10 years are to be obtained from the formula:

$$l_{10} = \frac{p_{(5-9)} - d_{(5-9)} \times 2.5}{p_{(5-9)} + d_{(5-9)} \times 2.5} \times l_5$$

Similar formula is used for computing survivors at higher ages, factor 5 being used for 10 year intervals.

The formula allows for the rapid decrease in mortality in the first four years of life, whereas in the succeeding age-groups change in mortality is assumed to be similar throughout that period.

[1] Length of Life, A Study of the Life Table, by L. I. Dublin, A. J. Lotka and M. Spiegelman. Revised edition. Published by the Ronald Press Co., New York, 1949.

Example: This method is applied to the average mortality experience during 1945-46 of the male population under Singur Health Centre area in West Bengal.

Basic data

Births 1758; deaths under one year 347;

Age group	Population	Deaths
1—4	3,872	126
5—9	4,571	69
10—19	7,433	46
20—29	5,894	63
30—39	4,379	63
40—49	2,917	62

$$\text{Surviving one year} = 100{,}000 - \frac{347 \times 100{,}000}{1758} = 80{,}261.66$$

$$\text{Surviving 5 years} = \frac{3872 - (126 \times 1.2)}{3872 + (126 \times 2.8)} \times 80{,}261.66 = 70{,}686.80$$

$$\text{Surviving 10 years} = \frac{4571 - (69 \times 2.5)}{4571 + (69 \times 2.5)} \times 70{,}686.80 = 65{,}545.67$$

$$\text{Surviving 20 years} \quad \frac{7433 - (46 \times 5)}{7433 + (46 \times 5)} \times 65{,}545.67 = 61.611.05$$

$$\text{Surviving 30 years} = \frac{5894 - (63 \times 5)}{5894 + (63 \times 5)} \times 61{,}611.05 = 55{,}359.65$$

The survivors at the succeeding ages can be obtained in the same manner. The table below shows the survivors at different ages.

Year of age	Survivors
0	100,000
1	80,262
5	70,687
10	65,546
20	61,611
30	55,360
40	47,930
50	38,721

18.6 Life table method applied to follow-up studies

In follow-up studies of patients suffering from chronic disease, one may ask, as in constructing a life table, how many out of a group of 100,000 cases survive 1 year, 2 years, 3 years, and so on after the onset of the disease or after a certain treatment. Such numbers are compared with those of another group of patients receiving different treatment or with patients of different age and sex, or possibly with cases of different degrees of infection. Life table technique has been used frequently in connexion with such studies. To name a few, Robins and Sachs[1] have studied its applicability to hospital patients, J. Ipsen[2] applied the method to multiple sclerosis, Berkson and

[1] An application of biometry to hospital statistics: Hospital stay tables, by M. Robins and R. Sachs. American Journal of Public Health, Vol. 43, p. 175, 1953.

[2] Life expectancy and probable disability in multiple sclerosis, by J. Ipsen. The New England Journal of Medicine, vol. 243, p. 909, 1950.

Gage[1] to cancer, and some workers have made follow-up studies of mental patients by this method [2,3,4].

In most of the studies the basic rates first computed are those corresponding to the life table mortality rate q_x. On the basis of this rate successive changes occurring in a cohort can be easily studied. The concept of life table mortality rate has often been applied to the estimation of risk of contracting a disease during each year of exposure. For instance, Wade Hampton Frost[5] made a follow-up study of family contacts of pulmonary tuberculosis in 132 Negro families in Kingsport, Tenn., USA. The following information was compiled from observation of children under 5 years of age.

Age in years	Number present beginning of year	Number added during year	Number withdrawn (living) during year	Number dying during year	Mean number present during year	Death rate per 1000 during year
(1)	(2)	(3)	(4)	(5)	(6)	(7)
0	363	0	15	18	346.5	51.9
1	330	3	3	4	328.0	12.2
2	326	3	16	6	316.5	19.0
3	307	4	12	0	303.0	0
4	299	5	14	3	293.0	10.2

Columns (2), (3), (4), and (5) give respectively the recorded figures of the number present, number added, number withdrawn and the number dying during the 5-year period studied. Thus 363 babies came under observation at the beginning of the first year of life. Of these, 18 died (column 5) and 15 were lost sight of (column 4) within their first year of life, so that a total of $18+15=33$ were withdrawn before completing the first year. Counting each child withdrawn as having been in the family for half a year, the aggregate of life experience is:

$$363-\frac{33}{2} \text{ years or } 346.5 \text{ person-years.}$$

This is shown in column (6). In the second year of life, the cohort comprised 330 of whom 4 died and 3 were lost sight of but 3 new children were added in the course of the year. Allowing half year as the mean time spent in the household for each newly added person and each one withdrawn, the total life experience for the second year is:

$$330+\frac{3}{2}-\frac{3+4}{2}=328$$

[1] Survival curve for cancer patients following treatment, by J. Berkson and R. P. Gage. Journal of the American Statistical Association, Vol. 47, p. 501, 1952.

[2] Expectation of mental disease, by H. M. Pollock and B. Malzberg. Mental Hygiene, vol. 8, p. 132, 1928.

[3] The incidence of mental disorder, by E. Slater. Annals of Eugenics vol. 6, p. 172 (1934-1935).

[4] The derivation of rates of separation from mental hospitals. Mental Health Division, Department of National Health and Welfare, Ottawa, Report Series No. 1, 1955.

[5] Risk of persons in familial contact with pulmonary tuberculosis, by Wade Hampton Frost. American Journal of Public Health, vol. 23, p. 426, 1933.

The other values in column (6) were worked out in a similar manner.

The annual risk of dying can then be computed by dividing the number dying (column 5) by the mean number present during the year (column 6). This is shown in column 7. For instance for the first year of life the risk was measured as: $\frac{18}{346.5} \times 1000 = 51.9$ per 1000 person-years.

A similar rate may be worked out also for withdrawal.

18.6.1 *Follow-up of cancer patients*

In 1950 the WHO Expert Committee on Health Statistics reviewed various plans for presenting therapeutic statistics on cancer and recommended that survival and apparent-recovery rates should be calculated at the end of one year, two years, three years, etc., from the beginning of the observation; rates for the first five years being based on the total number of cases. For subsequent annual intervals the denominator of the rate should be the number still at risk at the beginning of that interval, cumulative rates for periods after five years being obtained by multiplying consecutive annual rates.

To collect necessary data, the Committee set out these definitions and rules:[1]

(*a*) The starting point of the first 12-month interval should always be specified. For the comparison of different methods of treatment, the date of first treatment for cancer may be the starting point; for the study of the efficiency of medical care or for public health purposes the date of first diagnosis of cancer may be the starting point; for cases diagnosed in a hospital this will be considered to be the date of the visit or of the admission during which diagnosis is made.

(*b*) It is very important for accurate evaluation of therapeutic results to achieve a complete follow-up of all patients, and every effort should be made to trace each patient. Those who cannot be traced after each 12-month interval should be assumed, for purposes of uniformity and comparability, to have died of unknown causes during that interval.

(*c*) All cases diagnosed as cancer, whether treated or not, should be included with the exception of patients referred for diagnosis only.

(*d*) It is desirable that all diagnoses be confirmed histologically, but every patient diagnosed as having cancer should be included whether or not the diagnosis has been verified histologically. For special purposes those not so verified may be studied separately.

(*e*) Patients should be classified according to the site of cancer originally diagnosed. If another primary cancer develops, it should be considered as an intercurrent disease.

(*f*) It is desirable that the condition of patients classified as alive with no evidence of the disease should be established through examination by the reporting physician or hospital.

(*g*) Patients should be classified according to their condition at the end of each reporting 12-month interval, whether or not they have been successfully treated for a recurrence.

[1] Quoted from WHO Technical Report Series No. 25, pp. 24-25, 1950, Geneva.

To calculate the rates, the condition of each patient at the end of each 1-2 month period is recorded and tabulated as follows:

Number known to be alive

1. Number with no evidence of the disease
2. Number with cancer present
3. Number with presence of cancer uncertain

Number known to be dead

1. Number with no evidence of the disease
2. Number with cancer present
3. Number with presence of cancer uncertain at death

Number untraced at end of year.

With these data crude and corrected survival rates, and crude and adjusted apparent-recovery rates can be computed. Crude survival is defined as the number known to be alive at end of year expressed as ratio of the number known to be alive at beginning of year. The crude apparent-recovery rate for each annual interval up to the fifth year is similarly calculated as the number alive with no evidence of the disease at end of the annual interval expressed as ratio of the number alive at beginning of the first year. Crude survival rate is corrected by allowing for natural mortality. Apparent-recovery rate is adjusted by allowing for patients whose condition at the end of the interval was uncertain and for those who died during the 12 month period with no evidence of the disease. For the details of these adjustments the reader is referred to WHO Technical Report Series No. 25: Expert Committee on Health Statistics. Report on the Second Session, 1950, pp. 25-26.

CHAPTER 19

Charts and Diagrams

19.1 Uses of diagrams

Diagrams or charts are an effective means of ensuring that the salient features of the data are readily understood. They summarize the data at a glance, have a universal appeal, create an effective impression, and are able to carry the message to the mind in a language understood even by those to whom statistics have little appeal. For this reason diagrams are a powerful instrument in the hands of administrators and propagandists. But unfortunately diagrams are liable to be misused in the presentation of facts or may inadvertently tempt us to create a false impression.

The feature of displaying the results by means of diagrams is well known and is frequently exploited by health educators and statisticians alike. Yet another feature of considerable value is their use as statistical techniques for understanding hidden patterns or relationships or revealing comparisons in a mass of data. In this respect, diagrams provide an altogether novel method of analysing the information, suggesting what further statistical treatment could appropriately be carried out. In addition they provide a check on accuracy or consistency in a series of figures. In the words of the eminent statistician Sir Ronald A. Fisher,[1] "Diagrams prove nothing, but bring outstanding features readily to the eye; they are therefore no substitute for such critical tests as may be applied to the data, but are valuable in suggesting such tests, and in explaining the conclusions founded upon them."

19.2 Selection of the diagram

To draw a good diagram is an art which requires understanding of certain fundamental principles, as for instance:

1. Determine the significant message in the data.
2. Be familiar with the different types of charts and make the correct selection.
3. Consider the audience for which the graph is intended and select the design accordingly.
4. Understand the equipment and skill used in drafting, such as the general layout, lettering, colour scheme, thickness of lines and choice of material.
5. Understand how, by a choice of scales the same data can create different impressions.

[1] Statistical Methods for Research Workers, by R. A. Fisher. Oliver & Boyd, London. 1954.

Many diagrams can be easily prepared with the help of a typewriter for incorporation in typed reports. For large-scale charts needed for exhibition, etc., simple drawing instruments would suffice, as for instance: ruler, transparent set square and protractor, coloured inks and pencils, line pen, lettering sets, graph sheets and drawing paper.

As far as possible, only simple diagrams should be used. In selecting the type of diagrammatic presentation, one should recognize different types of data, such as chronological, geographical, quantitative and qualitative. Some of the most commonly used forms of diagrams are the line chart, bar diagram, map diagram, pie diagram and correlation diagram.

Some elements common to all diagrams are:

1. *the heading* or title in clear, concise form indicates precisely what data are shown, for which area or population group and for which period or point of time,
2. *the scales* clearly indicating the units represented,
3. *the source* of the data.

In addition, the diagram should be attractive, display good draftsmanship, produce a truthful impression on the reader and be simple enough to be readily understood.

19.3 Line charts

The chart most commonly used for studying or exhibiting continuous variations in indices or quantities in relation to time, season, age, or years, is the line chart. Time or age, as specified in terms of weeks, months or years, is marked along the horizontal axis, called the abscissa. The values of the quantity or index are plotted vertically above the corresponding time point on the abscissa; the height of the point being proportional to its value. The vertical scale is shown along the axis called the ordinate. The plotted points are connected by solid or symbol lines.

A simple example of the line chart is Fig. 16.1a in which annual crude death rate per 1000 population for New York City has been plotted for a century and a half. Figure 16.4b illustrates the use of the line chart in the study of variation in mortality by age.

On the time scale, the variable measured along the vertical axis may relate either to a period or to an instant. For instance, monthly or annual death rates relate to occurrences in a specified period of time (period data), or if we are interested in the percentage of persons suffering from a disease on any single day, the information would relate to a point on the scale (point data). Period data are conveniently shown by choosing in the time scale a point in the middle of the period concerned.

The selection of proper scales is important to ensure that all principal details are clear. If the scales are not properly chosen, then for the same data the chart can give an erroneous impression of either rapid or slow change. In Fig. 19.3a, for example, in one case the horizontal scale and, in the other, the vertical scale, is too narrow. From the same series of figures we then get an impression of either a very rapid increase or slow change

INFANT MORTALITY RATE PER 1000 LIVE BIRTHS, SWEDEN, 1750-1955

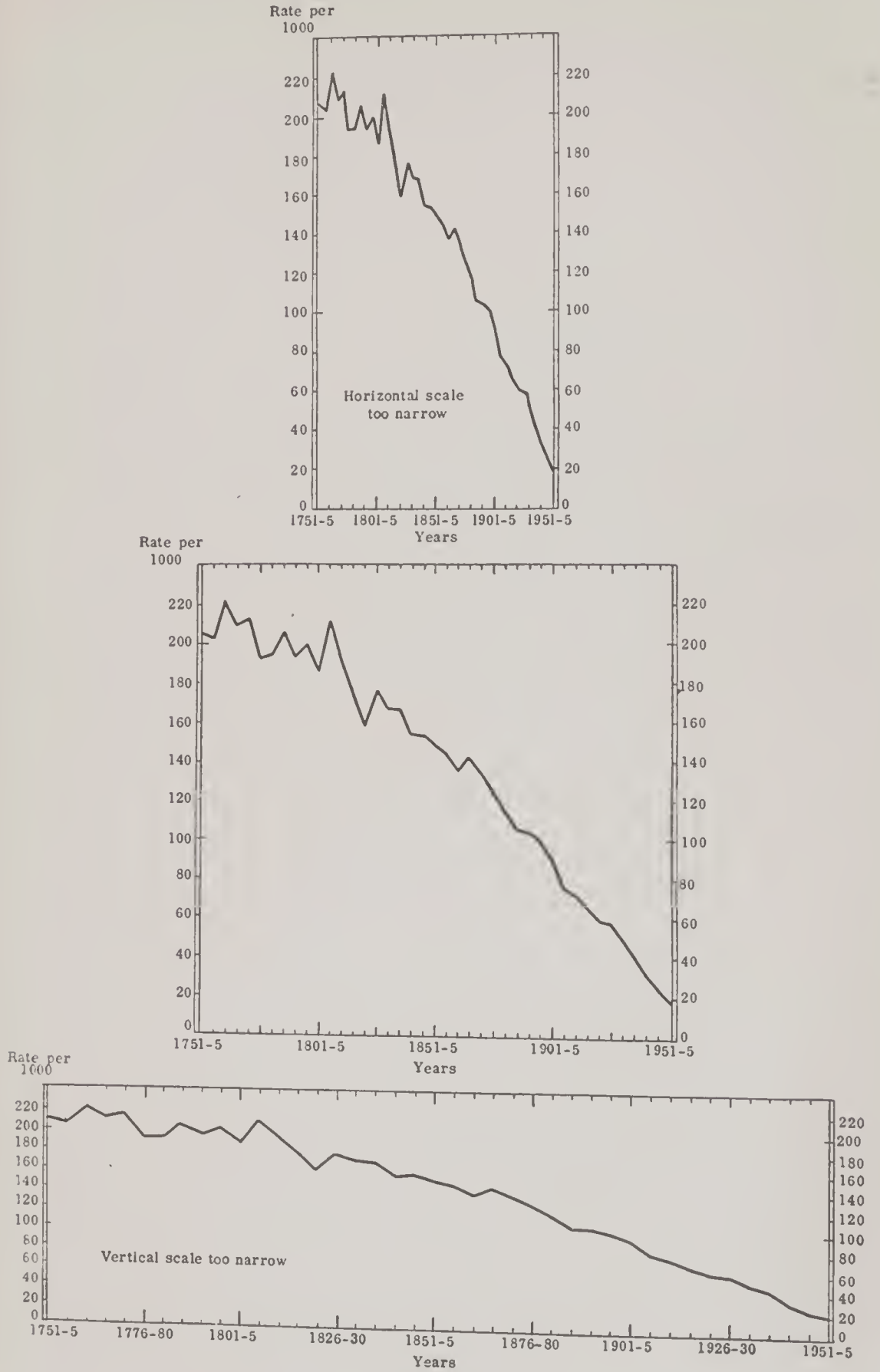


Fig. 19.3a

INFANT MORTALITY RATE PER 1000 LIVE BIRTHS, URUGUAY, 1901-1955

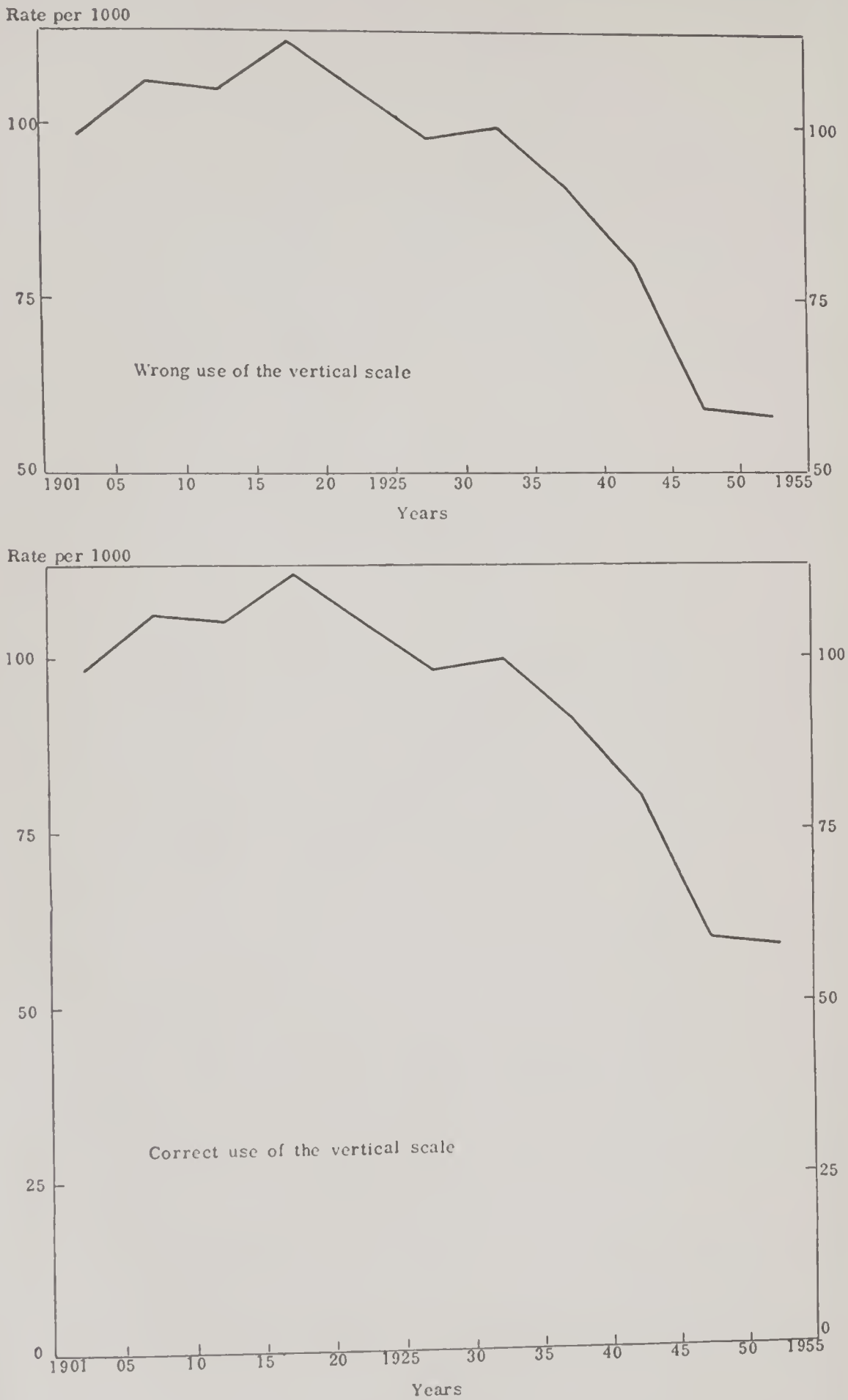


Fig. 19.3b

WEEKLY CHOLERA CASES IN CALCUTTA, 1950-1956

Week	1950	1951	1952	1953	1954	1955	1956	Maximum	Median	Minimum
1	44	52	34	7	-	3	-	52	7	-
2	42	41	29	10	2	2	-	42	10	-
3	91	76	24	20	1	4	-	91	20	-
4	135	60	20	26	4	1	-	135	20	-
5	187	82	32	20	1	-	1	187	20	-
6	177	71	31	8	2	-	-	177	8	-
7	110	96	22	12	4	1	-	110	12	-
8	170	87	80	16	1	-	-	170	16	-
9	135	86	105	58	3	-	1	135	68	-
10	199	107	67	122	2	2	5	199	67	2
11	253	168	91	166	2	3	3	253	91	2
12	312	117	112	159	20	17	16	312	112	16
13	365	158	81	274	30	9	22	365	81	9
14	406	160	137	263	34	17	35	406	137	17
15	685	203	134	232	122	26	62	685	134	26
16	777	210	212	279	127	50	98	777	210	50
17	709	322	264	293	136	93	161	709	264	93
18	492	337	337	252	115	135	221	492	252	115
19	490	281	272	340	120	200	221	490	272	120
20	422	253	203	304	113	148	255	422	250	113
21	308	286	155	280	128	195	213	308	213	128
22	316	256	119	229	77	184	179	316	184	77
23	318	233	99	235	59	214	248	318	233	59
24	283	222	70	335	76	303	140	335	222	70
25	260	182	90	526	77	297	80	526	182	77
26	193	144	114	538	57	236	53	538	144	53
27	197	112	78	520	48	203	43	520	112	43
28	180	103	59	299	37	121	19	299	103	19
29	158	95	34	151	24	64	15	158	64	15
30	141	101	15	91	20	30	5	141	30	5
31	115	81	20	58	7	22	11	115	22	7
32	84	82	34	41	9	15	3	84	34	3
33	66	82	13	36	10	8	3	82	13	3
34	62	84	18	21	8	12	4	84	18	4
35	49	35	11	17	5	15	11	49	15	5
36	49	66	12	9	8	7	12	66	12	7
37	29	42	8	10	6	-	9	42	9	-
38	30	33	4	11	1	3	1	33	4	1
39	25	38	9	14	1	1	2	38	9	1
40	17	28	16	6	3	-	7	28	7	-
41	19	32	11	2	3	5	6	32	6	2
42	28	66	4	6	4	-	2	66	4	-
43	41	63	7	3	-	1	3	63	3	1
44	29	57	8	8	1	1	2	57	8	1
45	53	50	14	2	-	2	1	53	2	1
46	45	52	7	6	2	1	1	52	6	1
47	46	56	12	2	4	-	5	56	5	-
48	25	77	7	-	1	-	21	77	7	-
49	17	70	3	-	2	-	4	70	3	-
50	18	41	6	3	2	-	4	41	4	-
51	59	50	8	2	2	-	3	59	3	-
52	68	41	6	3	2	-	2	68	3	-

N. B. The maximum value for each week is underlined.

WEEKLY MAXIMUM, MEDIAN AND MINIMUM CHOLERA CASES, CALCUTTA, 1950 TO 1956

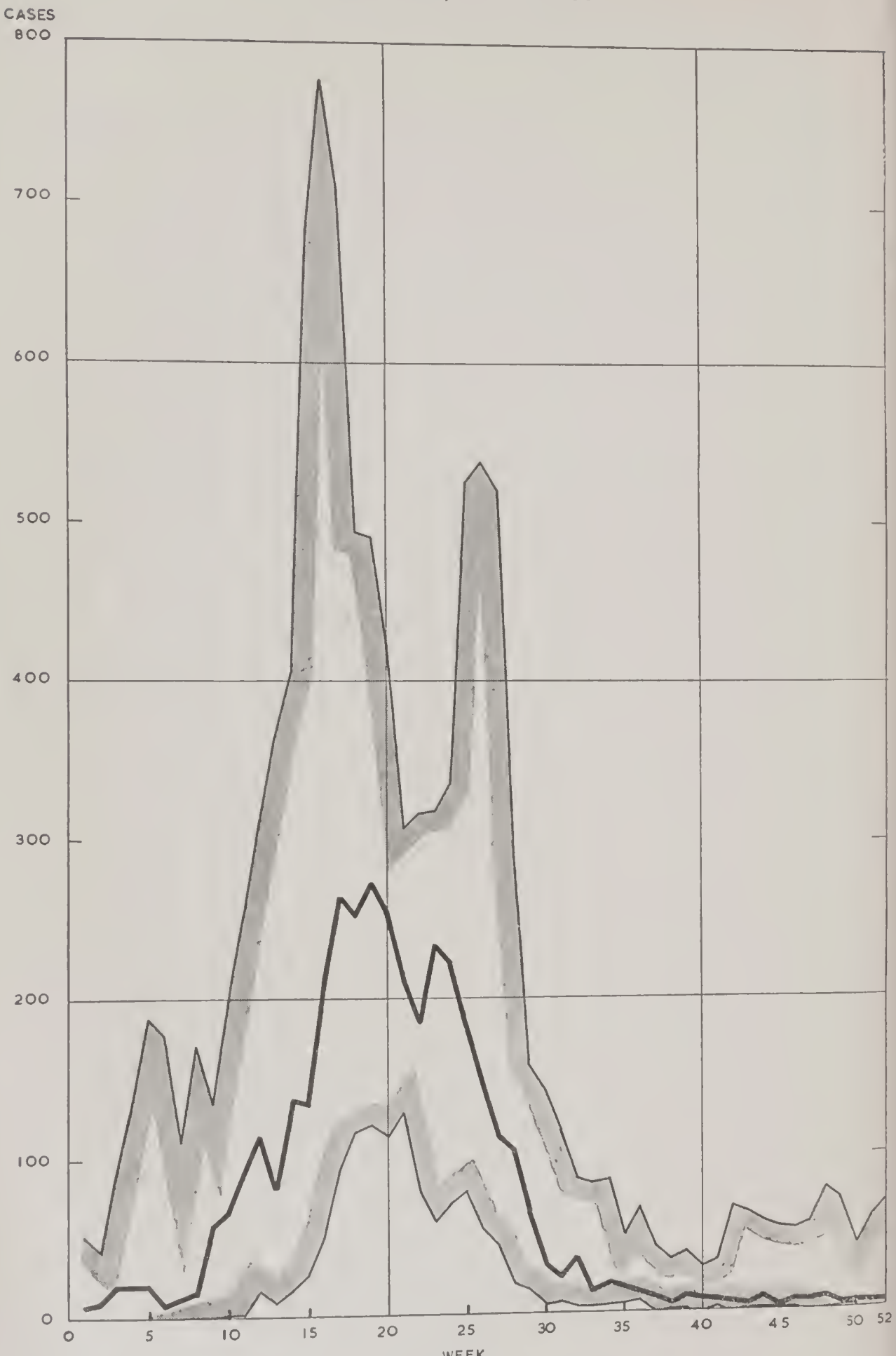


Fig. 19.3c

according to the scale chosen. In the preparation of graphs, therefore, the magnitude of the changes should be interpreted with care by mentally translating the points into actual figures.

Another common mistake leading to wrong interpretation is to begin the vertical scale above zero. Figure 19.3b, for example, shows in separate line charts the trend of infant mortality rate in Uruguay from 1901 onwards. In one chart the ordinate starts from zero at the baseline (which is the correct procedure);in the second the ordinate wrongly starts from 50. In the latter case the figure gives a rather false impression of a more rapid decrease in the rate.

In addition to studying long-term trends in births, deaths, or other rates, a line chart is frequently used to establish seasonal variations of important diseases. For this purpose, monthly or preferably weekly figures of cases are set out in tabular form for seven or nine previous years as in the table for cholera cases in Calcutta City from 1950 to 1956. For each week the median value, i.e. the middle value in order of magnitude, is picked out. The maximum and the minimum values are also noted. A line chart is then prepared showing the three series of figures by separate symbol lines (see Fig. 19.3c). The advantage of establishing a diagram in this manner for important diseases of an area is that the variation of each disease incidence can be easily watched from time to time. As the latest weekly figures become available they are plotted on the same chart so that the trend of the current outbreak as well as its level, can be kept under constant review.

When figures of disease incidence are produced for a great number of years, health workers get an idea of any possible cyclical variation or periodicity in disease incidence. The fluctuations of the disease incidence can be studied in relation to meteorological factors. A line chart is also of value in the study of the growth of total population or of population in separate age or sex groups. Similar charts are used for the study of growth in height or weight of children.

A useful application of a line chart is shown in the study of indices beginning with a common base — 100 for instance. An example is Fig. 19.3d showing index trends of the age-specific death rates for Switzerland from 1900-01 to 1950-51. The purpose is to place various indices, which of course have different values at the base year, at a common level of 100, so as to study relative decrease. Such charts are useful when comparing the relationship of two or more series which may differ considerably in amount or quantity or in the measures used, that is, when they are expressed in different basic units.

The study of indices in this manner may sometimes be misleading. As an illustration, consider the following data relating to the amount of money spent each year on antimalarial measures and the annual number of malaria deaths in Ceylon from 1936 to 1955. The figures relate to two different units. We therefore convert them to indices or percentages of the average of the period 1936-1940, chosen as the base period, as in the following table:

Ceylon. Annual expenditure on antimalaria campaign and malaria deaths, 1936 to 1955

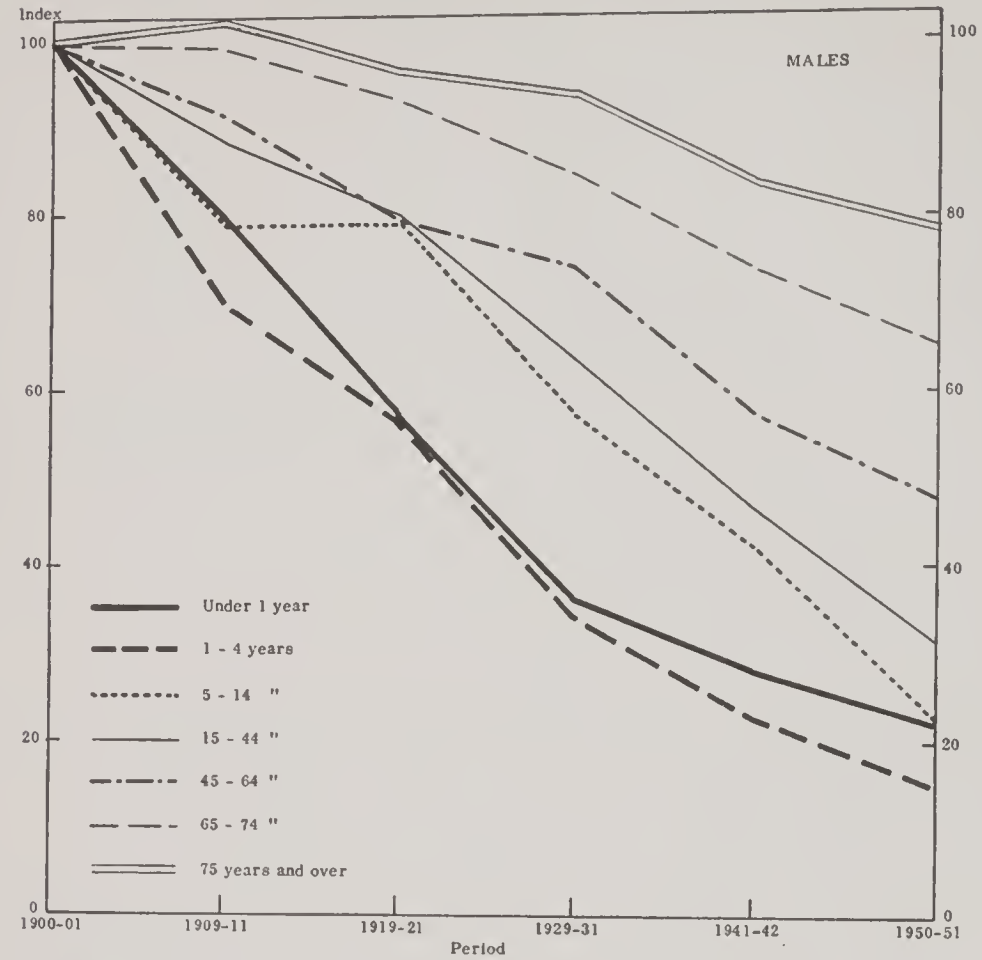
Year	Expenditure Rupees in thousands	Malaria deaths	Indices to base 1936-1940	
			Expenditure	Malaria deaths
1936	76	7613		
1937	70	4408		
1938	181	4778	100	100
1939	144	10039		
1940	139	9169		
1941	123	7132	100	99
1942	118	5143	97	71
1943	121	6765	99	94
1944	184	5604	151	78
1945	302	8539	247	119
1946	1708	12587	1400	175
1947	2428	4562	1991	63
1948	3995	3349	3275	47
1949	2908	2403	2386	33
1950	2687	1901	2204	26
1951	2888	1599	2367	22
1952	3284	1049	2692	15
1953	3517	722	2884	10
1954	2400	447	1968	6
1955	1860	268	1525	4

By the year 1955 the annual expenditure had increased about fifteenfold while the mortality decreased to one-twentyfifth of the base figure. In Fig. 19.3e (right-hand side) the two series of annual indices are shown by the line charts. The curve of mortality lies so low throughout the period that even a remarkable decrease to one-twentyfifth of the base figure is hardly brought out. This illustration points out that before deciding to show the data by line chart, we should consider whether we wish to study absolute changes or proportional variation. The line chart so far described is suitable for the study of the former. The ratio of change is appropriately studied by using logarithmic scale along the vertical axis. Inasmuch as the logarithmic scale has found many uses in health statistics, an understanding of this scale is necessary.

19.4 Logarithmic scale

When studying a series of figures over a period of time we are sometimes interested not so much in the actual amount of change as in the relative change or the rate of change. Two series of figures marked "x" and "y" (columns 1 and 2), are shown from 1941 to 1948. The "x" series records a constant increase of 200 units from year to year (column 3). In the "y" series the increase itself increases from year to year (column 4) but the percentage change from one year to the next is the same (column 6).

TREND OF MORTALITY INDEX IN DIFFERENT AGE-GROUPS.
SWITZERLAND, 1900-01 to 1950-51
(Mortality rate during 1900-01 is the index 100)



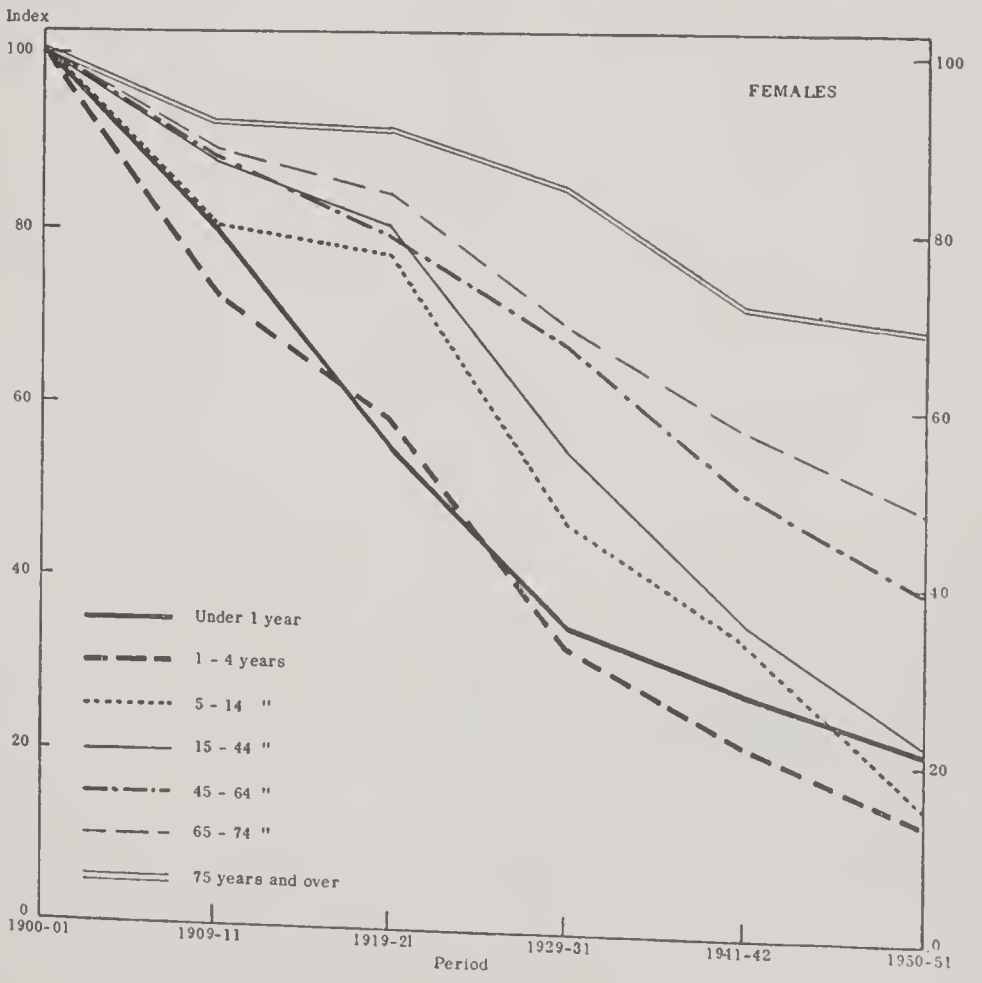


Fig. 19.3d

CEYLON ANNUAL INDEX OF EXPENDITURE ON ANTIMALARIA CAMPAIGN AND OF MALARIA MORTALITY, 1941-1955. (BASE PERIOD 1936-1940)

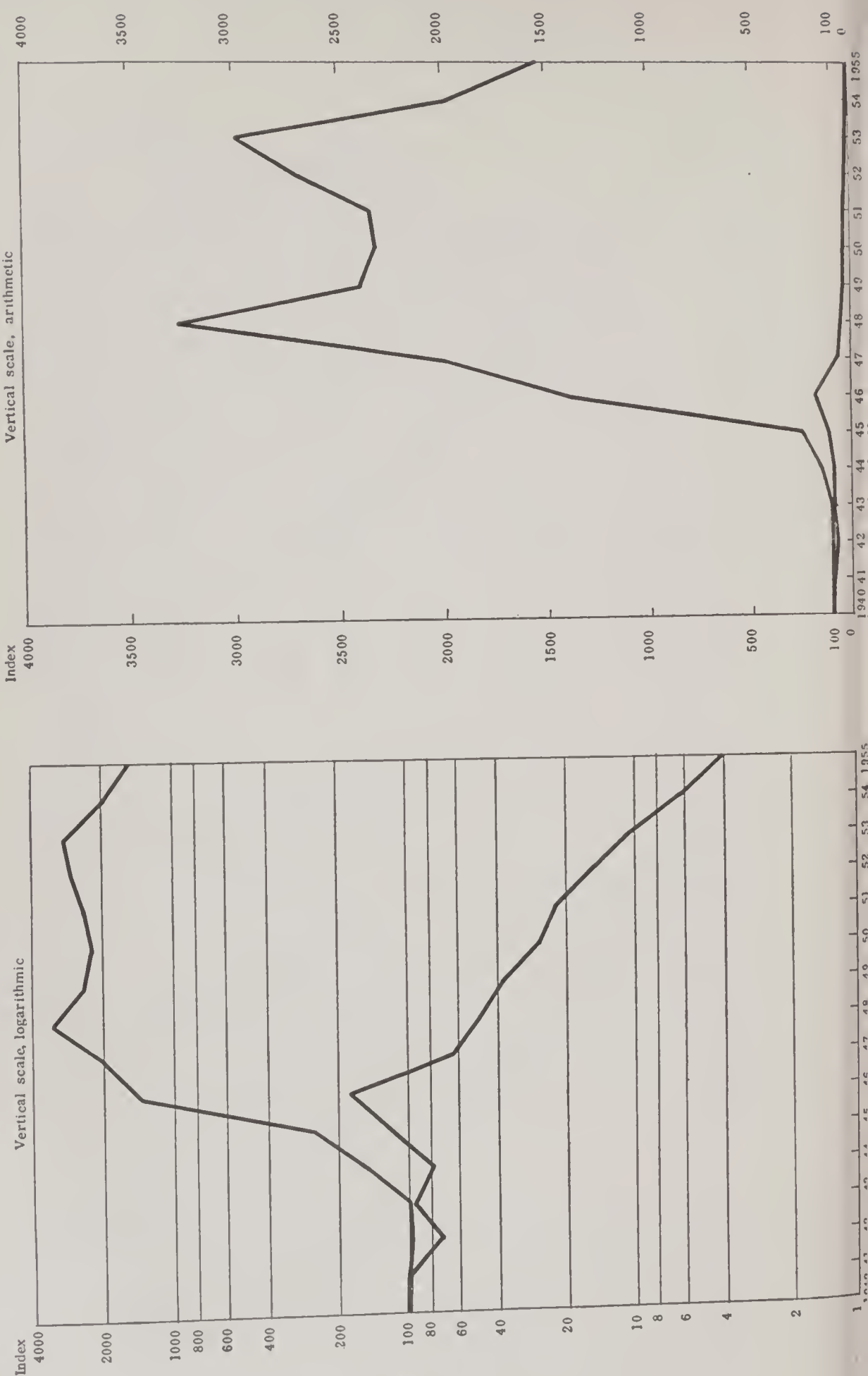


Fig. 19.3e

Year	x value arithmetic progression (1)	y value geometric progression (2)	actual amount of increase in		percentage increase in	
			x (3)	y (4)	x (5)	y (6)
1941	0	128				
1942	200	192	200	64	infinity	50
1943	400	288	200	96	100	50
1944	600	432	200	144	50	50
1945	800	648	200	216	33.3	50
1946	1000	972	200	324	25	50
1947	1200	1458	200	486	20	50
1948	1400	2187	200	729	16.7	50

If both the series of figures are shown on an ordinary chart (see Fig. 19.4a) the curves obtained are:

EXAMPLES OF ARITHMETICAL AND GEOMETRICAL RATES OF INCREASE

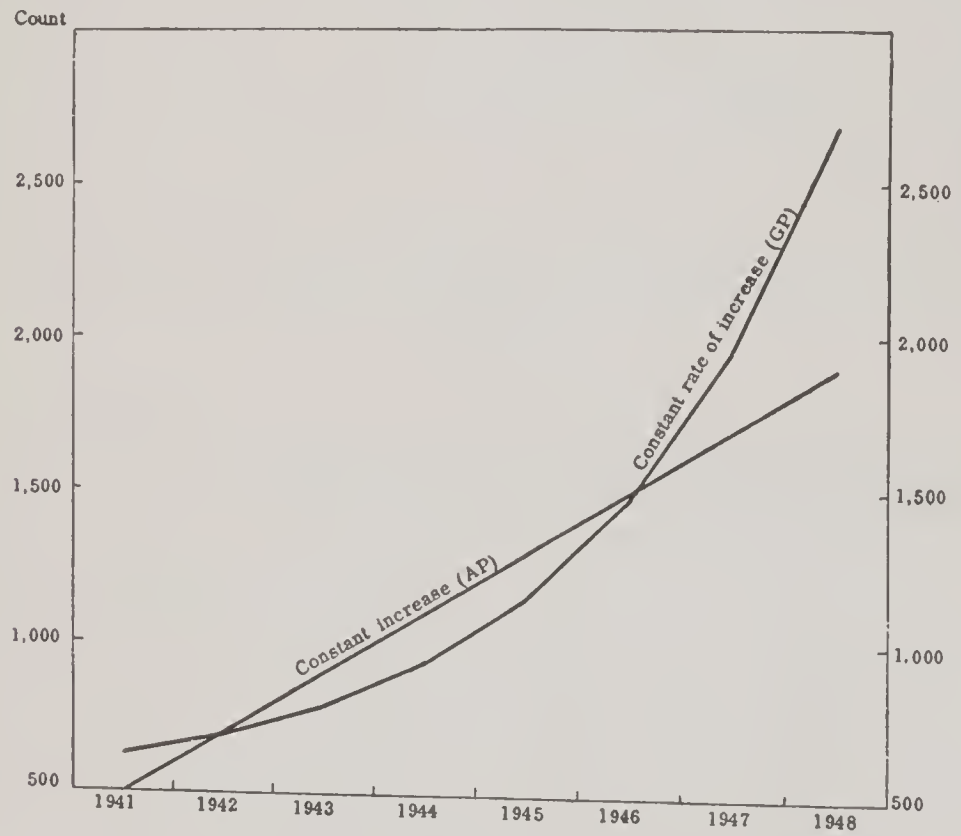


Fig. 19.4a

The x series follows a straight line course because the absolute increase from one year to the other is constant. The y series which in fact increases according to geometric progression, follows a curvilinear course. A mere inspection of the y series curve cannot therefore indicate to the eye whether the figures increase at a constant percentage rate. A curvilinear course may be followed by a series of figures whose rate of change from year to year is not constant.

In order to examine whether the percentage rate of increase is constant from year to year, two devices are available; we may take the logarithms

EXAMPLE OF CONSTANT RATE OF INCREASE (GEOMETRIC PROGRESSION) ON LOGARITHMIC SCALE

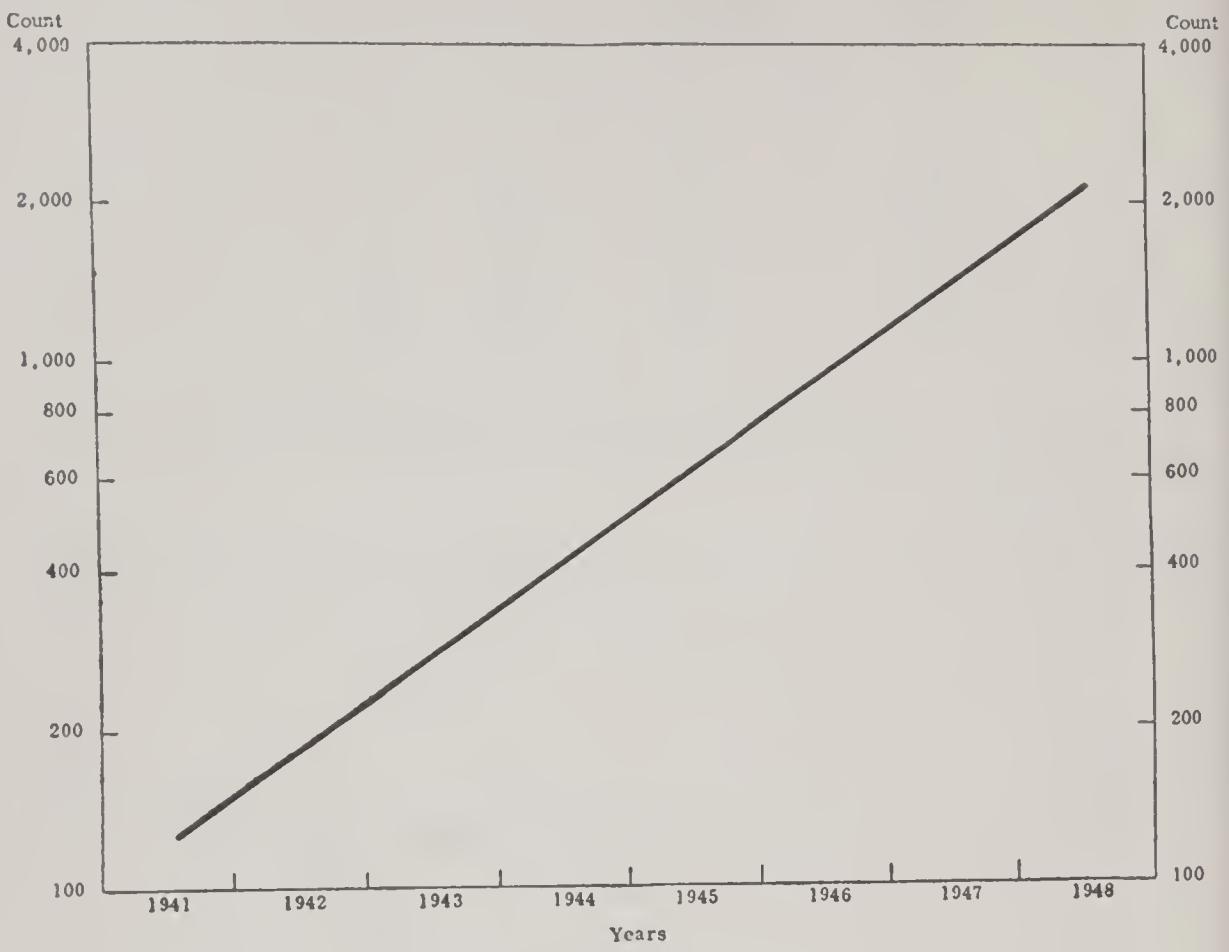


Fig. 19.4b

of the y series and make a chart or use the semi-log paper. The figures will then follow a straight line course, as shown below:

Year	y series	$\log_{10} y$	Increase in log values
1941	128	2.107	
1942	192	2.283	.176
1943	288	2.459	.176
1944	432	2.635	.176
1945	648	2.811	.176
1946	972	2.988	.177
1947	1458	3.164	.176
1948	2187	3.340	.176

If it is inconvenient to take logarithms of each value in the series, the work is facilitated by the device of using the logarithmic scale along the vertical axis. Printed sheets in which one of the axes is ruled with logarithmic scales are available and can be utilized for this purpose. The necessity for taking logarithmic values is thus altogether obviated.

Such graph sheets, in which the vertical scale is logarithmic, while the horizontal scale is marked at equal distances, are called "semi-logarithmic" or "ratio" sheets, because equal distances on the vertical scale show equal

ratios and not equal amounts. The scale is usually divided into cycles or phases of tenfold ratios. The ordinate does not begin with zero but usually with a quantity such as 1. The advantages of semi-logarithmic sheets are that:

1. If the points plotted arrange themselves along a straight line, this shows that the percentage rate of change is constant. Conversely, failure to follow a straight line course shows that the percentage rate of increase was not constant from year to year.
2. The slope of the line indicates the percentage rate of increase or decrease.
3. Two or more lines following parallel courses show that the series of figures increase at the same constant rates. In other words, absence of parallelism in the straight lines shows that the rates of change are not the same.

In health statistics there are many applications of the use of semi-logarithmic sheets, especially when studying relative changes in mortality rates; see for instance, the Ceylon data charted on semi-logarithmic paper (left-hand side of Fig. 19.3e). The two ratios of increase in cost and the decrease in mortality are now seen in proper perspective. An interesting example is reproduced from a study by Robert Farber and Matthew Tayback, of the tuberculosis mortality experience of cohorts by date of birth in Baltimore City (Fig. 19.4c).

It is also customary to chart epidemic outbreak figures on semi-logarithmic paper because this scale compresses, as it were, the abnormally high peaks and lifts the low figures so that minor fluctuations are readily seen.

19.5 Bar diagram

Bar diagrams are useful for studying the relative values of individual population groups or places. For instance, in chapter 17, crude birth rates, death rates and infant mortality rates for different countries are compared by means of the length of bars.

Similar bar diagrams can also be used for comparing causes of death, age distribution or other population characteristics. In each case, magnitudes to be compared are shown by proportional lengths of bars which originate at the right-hand side of a common vertical line and are measured along the horizontal axis. Ordinarily, the spacing between the bars is about half the width of the bar. The population group or category is identified by a statement on the left of each bar. As far as possible the bars are arranged in decreasing order of magnitude. In special cases it may be more expedient to arrange the categories in alphabetical or some other convenient order. The bars then appear irregular, although each population group can be more readily located. An example of such a diagram is Fig. 3.13b in which the annual rate of population growth is shown for two periods for various regions of the world.

Bar diagrams are also used for plotting figures in respect of time either when only a few selected dates or periods are to be shown or when occurrences are studied in relation to some known factor. For instance, in Fig. 19.5a

the bars arranged in chronological order show by means of different shading the origin of infection responsible for cholera deaths each year in the Punjab. Such bars should, of course, be placed vertically beginning from the horizontal baseline. Sometimes against each population group more than one bar is shown as, for instance, to exhibit infant mortality rates separately by sex or for separate periods. In that case the bars are shaded differently to distinguish the periods or sexes. Fig. 16.2a is an example showing for each age-group in England and Wales death rates for three separate periods.

As far as possible, the number of bars for each major group should be

TUBERCULOSIS MORTALITY EXPERIENCE OF COHORTS BY DATE OF BIRTH, BALTIMORE CITY

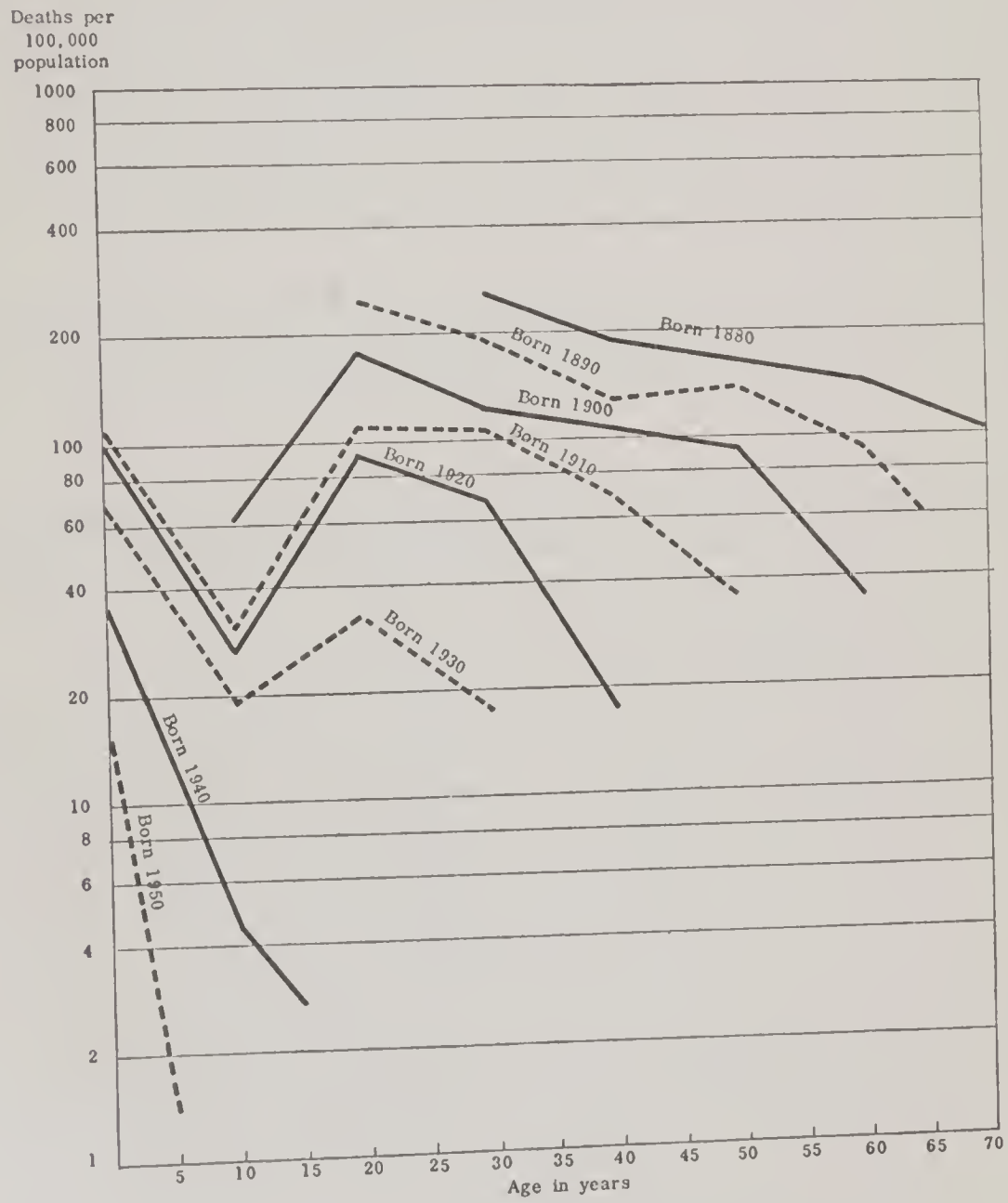


Fig. 19.4c

ANNUAL CHOLERA DEATHS IN THE PUNJAB, 1902-1957 AND SOURCES OF INFECTION

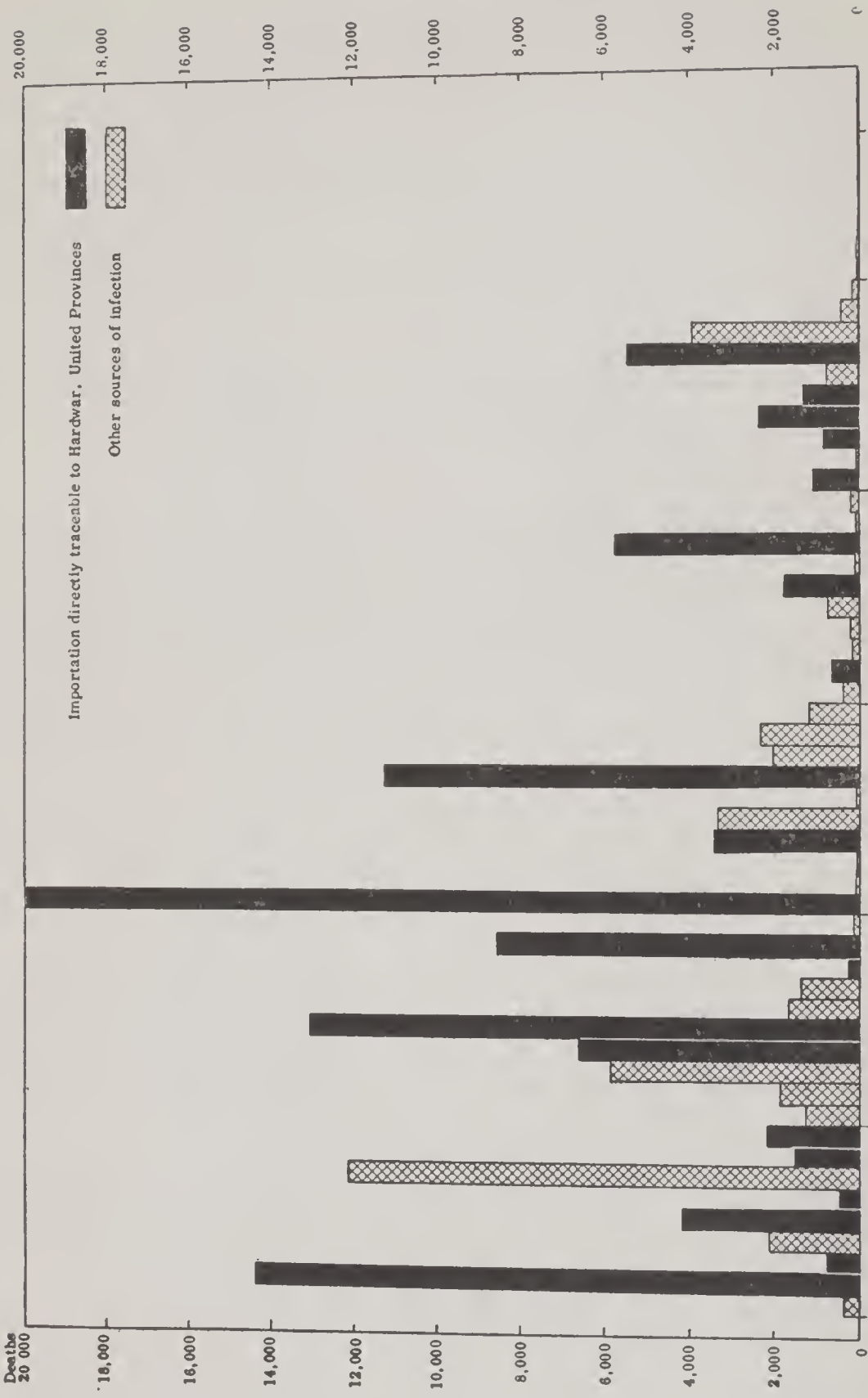


Fig. 19.5a

limited to a maximum of three or four, as more tend to confuse the picture.

19.5.1 *Population age pyramid*

An interesting use of bars is made for studying at a glance the age and sex distribution of the population by means of what is called a population age pyramid. Age intervals are located on the vertical scale and the corresponding populations or percentages are shown by bars horizontally on either side for the two sexes. In Fig. 19.5b the age pyramid of the German population at various censuses brings out both the effect of loss of life from wars and the aging of the population from 1910 to 1950. In Fig. 19.5c the population age pyramid is used to study the marital status of the population at different ages for Switzerland. The relative preponderance of widows at higher ages is revealed.

Another interesting use of the bar diagram is illustrated in figure 19.5d in connexion with the study of the change in age distribution of deaths from tuberculosis and cancer in Canada between 1926 and 1955.

19.6 Map chart

Maps depict geographical variation or distribution in space. Sometimes different areas are shaded or cross-hatched, as shown in Fig. 1.4a; the shaded portion running progressively from dark to light, depending upon the emphasis desired. This shading pattern should be sufficiently distinctive to show clearly the differences in area and yet use as few patterns as possible, not exceeding five or six. As the use of only a few categories sacrifices a good deal of information, this form of diagrammatic representation should be adopted only when a study of geographical distribution is of importance. Otherwise it is preferable to use bar diagrams.

If our interest does not lie in showing absolute magnitude but certain qualifying data as, for instance, the prevailing species of mosquitos, or location of hospitals or health centres, different types of symbols may be used to mark the places in the map.

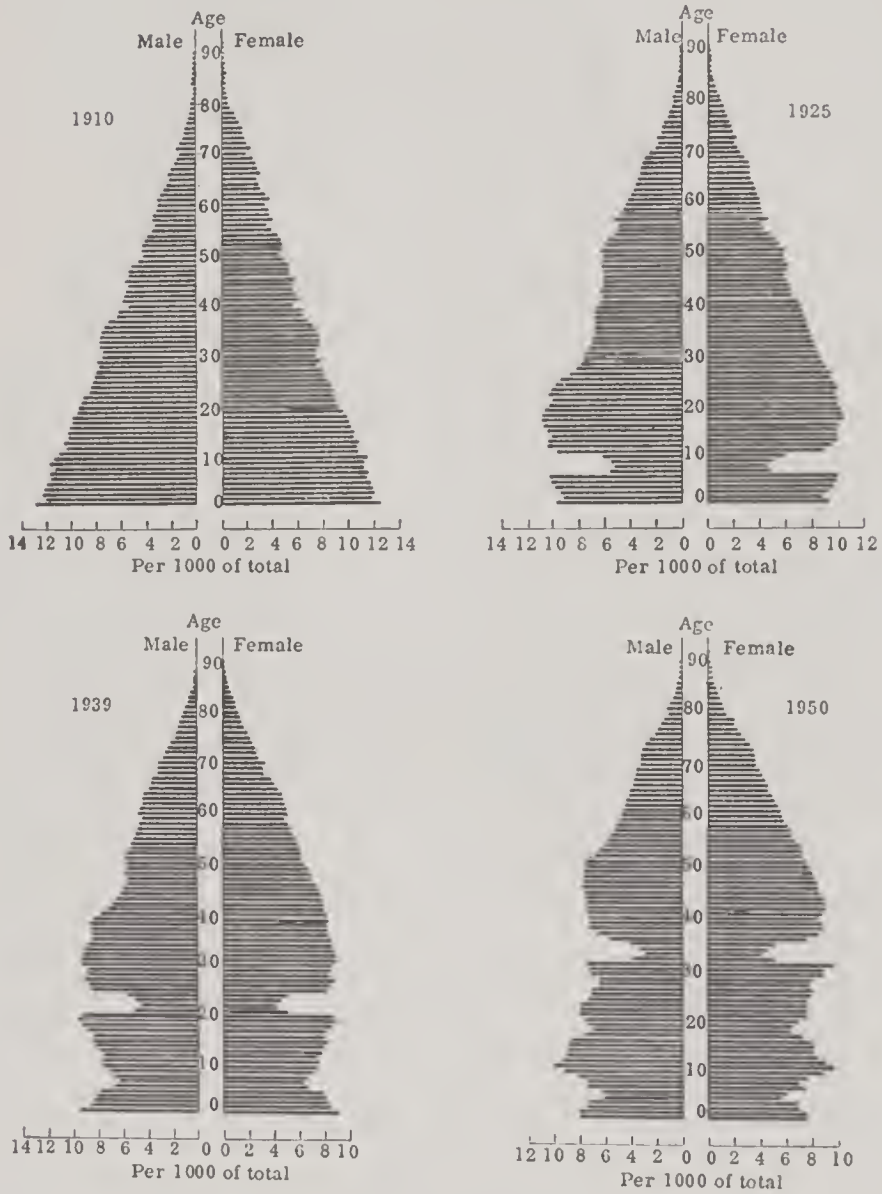
In the study of epidemics, where our object is to show the geographical distribution of individual cases, dot maps may be used, each dot representing a case or a death. Different coloured dots can be used to indicate cases and deaths of various diseases. Heavy concentration of dots can be avoided by using a single dot to denote five or ten cases each.

In epidemiological work, a blank map, showing the outline of the area, is mounted on a backing of wood or cork and the occurrence of cases or deaths is recorded by means of pins, usually having glass heads of different size, colour or shape. Pins are altered as the facts change. These maps are of value to a health officer in the study of disease outbreaks.

The use of dot maps is illustrated in Fig. 3.13a which shows the distribution of population in different parts of the world.

Maps also give valuable information in planning a survey. They are prepared in advance to show detailed topographical features, main channels of communication, crops grown, principal inhabited areas and density of

AGE AND SEX DISTRIBUTION OF THE POPULATION OF GERMANY, 1910, 1925, 1939 and 1950



Taken from: "Leben und Sterben in der Bundesrepublik Deutschland"
Edited by: The Federal Minister for the Interior, Department of Health, Bonn, 1953 (Der Bundesminister des Innern. Abteilung Gesundheitswesen)

Fig. 19.5b

MARITAL STATUS OF PERSONS 15 TO 74 YEARS OLD BY FIVE-YEAR AGE GROUP AND SEX, SWITZERLAND, 1950

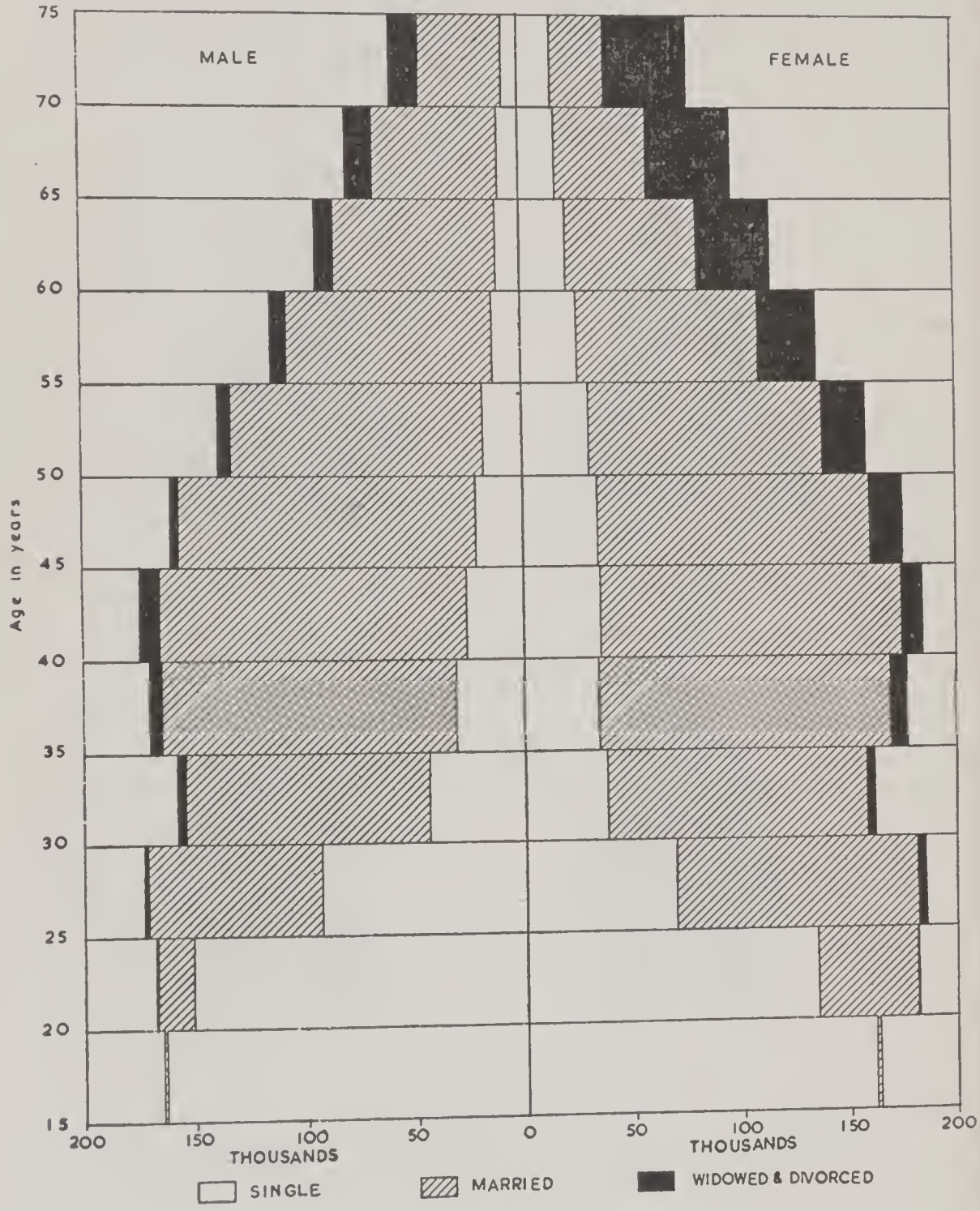


Fig. 19.5c

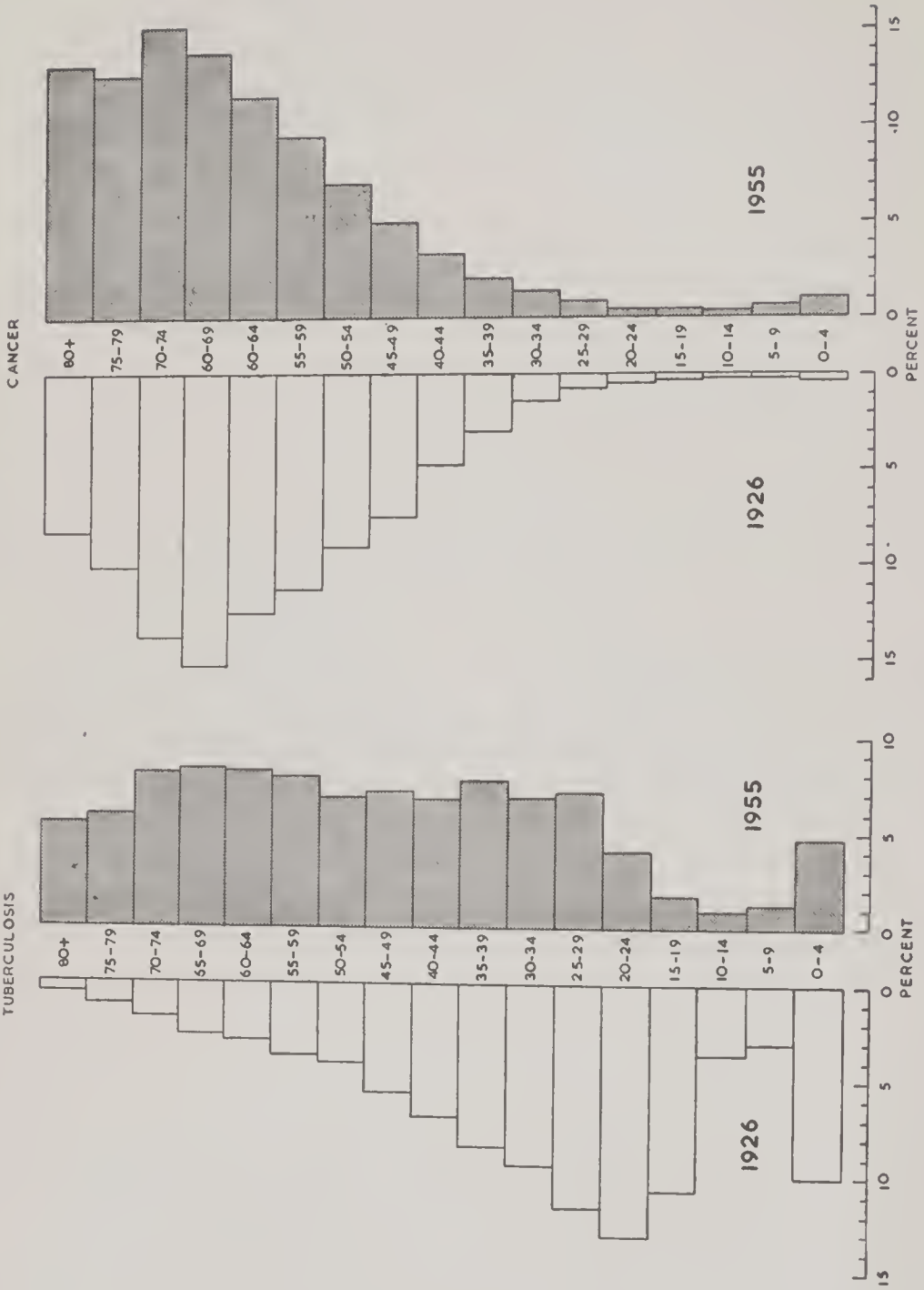

CANADA, 1926 AND 1955
AGE DISTRIBUTION OF DEATHS FROM TUBERCULOSIS AND CANCER
CANCER
TUBERCULOSIS
80+
75-79
70-74
65-69
60-64
55-59
50-54
45-49
40-44
35-39
30-34
25-29
20-24
15-19
10-14
5-9
0-4
1955
1926
PERCENT
15
10
5
0

Fig. 19.5d

population, nationality or ethnic distribution, level of health or morbidity on the basis of information from previous surveys or censuses, housing conditions, location of schools, hospitals, clinics, health centres and other public buildings, as well as streets, zones, parks, fields and forests, and ward or village boundaries. Other useful information on maps relates to water supply systems, wells, sewage disposal, dairy farms, milk plants, food establishments and industrial plants. The object of a detailed map is to give the survey staff their bearings and to provide a reference for those who read the report later.

19.7 Pie diagram

In pie diagrams the area of a circle is divided into different sectors, the angles of which are proportional to the percentages of the numbers in each constituent category. Such diagrams are used for comparative purposes, i.e. to study the relative importance of various quantities producing a comparable total figure. For instance, in figures 19.7 three pie diagrams show the relative contribution each major region makes to world total of births, deaths and natural increase. Distinction between various sectors is made by means of different shadings. The corresponding rates per 1000 population for each region are shown in the same figure by means of bar diagrams.

19.8 Correlation diagram

It is of interest to study whether the incidence of the disease is related to any meteorological or other factor. Many studies are on record where indices like the infant mortality rate or crude death rate are correlated with the density of population, number of persons per household, and so on. The number of cases of communicable disease is investigated in relation to the size of the household. As the first step, a correlation diagram is prepared. Such a diagram immediately suggests whether a further statistical study of the degree of correlation between any two factors is of importance.

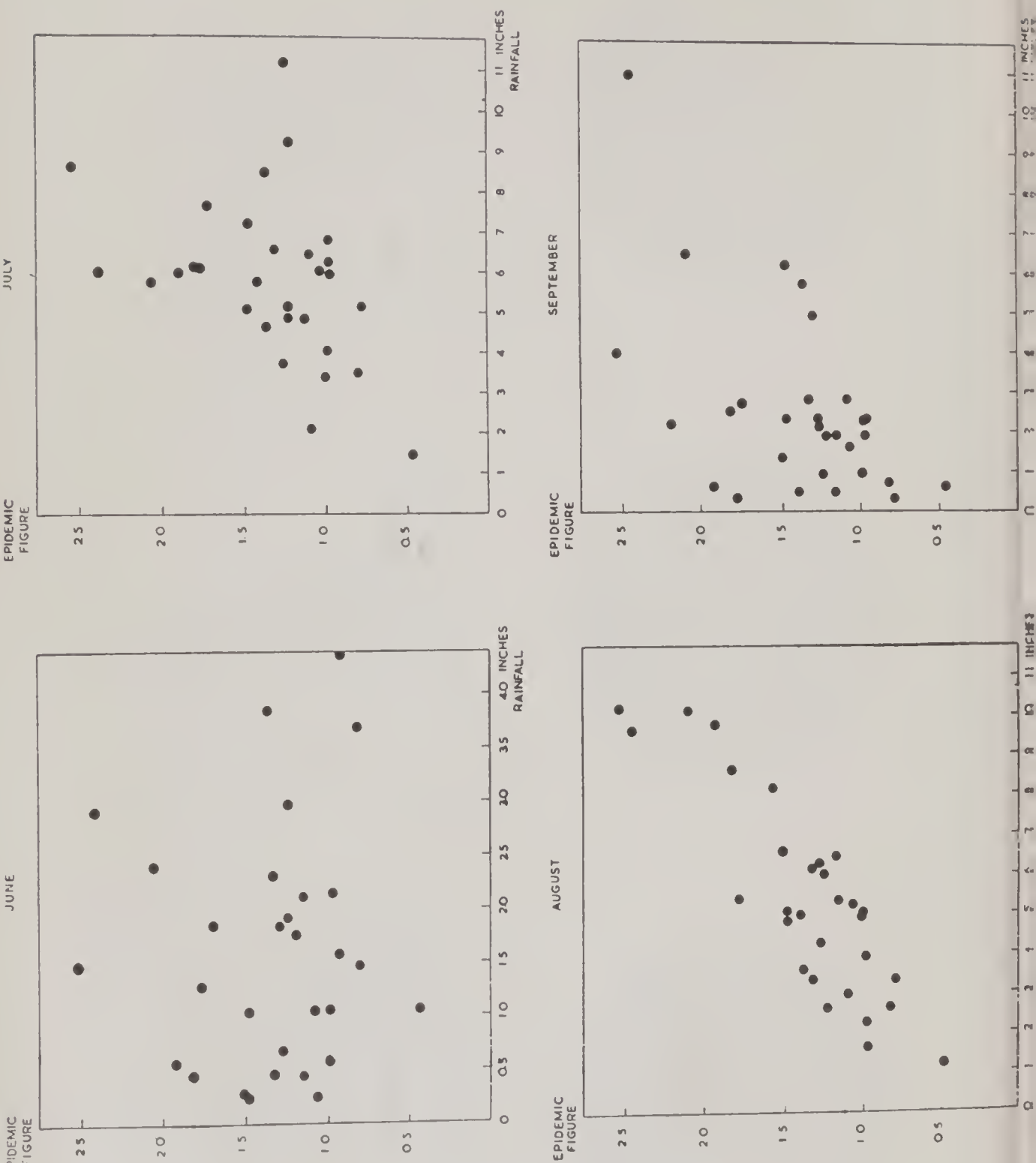
In constructing a correlation diagram, the horizontal and the vertical scales (see Fig. 19.8) are marked to represent the two variables. Each pair of values is then shown by a corresponding dot. In Fig. 19.8, four correlation diagrams are shown. The problem investigated is to what extent is malaria (as measured by an epidemic figure) correlated with the rainfall in different months. Malaria epidemics occur in the Punjab in the months of August to October. Rainfall is particularly marked during the monsoons, namely, July to August. If rainfall in the earlier months shows a high degree of correlation with the subsequent malaria outbreaks, a knowledge of the rainfall figure could afford a basis for forecasting the disease.

If the dots in the correlation diagram are haphazardly distributed then no correlation is suggested. On the other hand if they follow a pattern as for instance in the case of August rainfall and malaria, correlation is indicated. The more closely the dots are found to arrange themselves along a line, the higher is the degree of correlation.

DISTRIBUTION OF THE WORLD TOTAL NUMBERS OF BIRTHS, DEATHS AND NATURAL INCREASE, AND CORRESPONDING RATES, BY MAJOR GEOGRAPHICAL REGIONS, 1952-1956

Fig. 19.7

Fig. 19.8 CORRELATION DIAGRAMS OF MALARIA EPIDEMIC FIGURE AND MONTHLY RAINFALL PUNJAB, 1914-1943



CHAPTER 20

How to Measure Health

20.1 Need for a numerical measure of health

Although various approaches to determining the basic data have been mentioned, one which was later elaborated is three-fold: the health officer's need to:

1. measure vitality and health of the population;
2. study environmental and other factors and conditions influencing health;
3. appraise health facilities and evaluate the health services given to the community.

So far we are not in possession of any statistical index or measuring rod which can really tell us in numerical terms the level of health of a community. Therefore, if an administrator or a politician were to ask the statistician to state precisely in easily understood terms how healthy his community was, the statistician would have no satisfactory answer. Indeed, the problem is difficult in the extreme because we do not yet know how to assess numerically the state of health of even a single individual in the community.

20.2 Definition of health

Neither health nor ill-health can be precisely defined. Yet they constitute a spectrum which runs from perfect health — however defined — at one end, through varying degrees of ill-health to serious illness resulting in death at the opposite end. Positive health is not a quality; it is more than a mere direction away from disease or negative health. It has been said that health is more than mere absence of disease in the same sense that truth is more than absence of error. Furthermore, the term "health" conveys something like the meaning of "wholeness" or "wellness" implying that a perfectly healthy person is one totally adjusted to himself and his environment.

The clinician's main interest is to examine the patient for defects or presence of disease. He uses various diagnostic techniques and considers in his mind whether the individual is free from disease or defects. Asked for his judgment on the state of health of an individual, he may no doubt venture some subjective statement, such as excellent health, good health, fair or poor health, or may even classify an individual under a simple category like, "healthy without defect, healthy with abnormality, healthy with scars, healthy with latent disorders, or lastly, sick, i.e., affected by disease, ailment or result of injury, or by physical or mental defect including departure from normal health and requiring treatment and convalescence". Nevertheless

the health of an individual cannot be measured numerically on a scale, like temperature, blood pressure, etc. But can it be measured at all?

There is a limit to how far a clinician can go in measuring health, even with all the latest diagnostic techniques at his disposal. He cannot yet express the state of physical health of an individual on any agreed scale of values. With this difficulty in mind one can now visualize how much more difficult it would be for a health worker to quantify the state of health of a group of individuals. Various numerical indices developed and used by health statisticians are merely designed to diagnose and measure community ills. They only serve the purpose of what has been called "negative indices of health" and not "health" as such, or "positive health". Their chief merit is that they can express results on a numerical scale but must still leave the interpretation of the difference in values in the realm of the subjective. For this reason, the search for a suitable yardstick of community health is still going on.

The problem is of such fundamental importance that in the meantime some kind of answer has to be given. We should first distinguish between the two concepts of measuring the state of health and the state of ill health.

20.3 Historical development

Considerable thought has been given to the problem of stating numerically the level of health, and the older literature on the subject offers various suggestions such as nutritional indices, productivity in the manufacturing groups, stature or physical constitution, average lifespan, percentage of old people in the population, and the rate of natural growth of the population. Those who give further thought to the problem may put forward a few more suggestions on similar lines. During the last war, the question arose of assessing the fitness of recruits to the armed forces. The Canadians developed what is called the "PULHEEMS" system for this purpose. It was later modified for use by the armed forces of Great Britain and the United States.[1]

One could thus produce a substantial list of indices, but then the problem would be to select. On what criteria should such a selection be made, i.e., which one is preferable to another, and in fact measures what we wish to measure?

20.3.1 *Studies initiated by the United Nations*

From an administrator's point of view the problem is vital and in postwar years some advance has already been made. Indirectly one can trace back the origin of the more recent work to the Charter of the United Nations (Article 55) which stipulates that the United Nations shall promote "higher standards of living". In 1952, the General Assembly took note of this stipulation and asked that the United Nations should pay special attention to changes occurring in the standard of living of the working population and make provision for working out adequate statistical methods and techniques for the gathering and use of pertinent data and publish regular annual reports

[1] Experience of PULHEEMS in the 1952 Army Intake, by S. Rosenbaum. British Journal of Industrial Medicine. Vol. 14, pp. 281-286, 1957.

showing changes in the absolute levels of living in all countries. One can well imagine that to measure "levels of living" as a whole would be even more difficult than to measure levels of health alone. The Secretary-General of the United Nations convened a committee of experts to advise on how the level of living might be measured. The Committee was not able to present a final and definite answer to the many complex problems with which it dealt, but did reach agreement on the ways of approaching these problems. In the first place, it sought to clarify the term "standard of living" versus "level of living" and related concepts, and recommended that in future discussions the term "level of living" be employed when reference is made to actual conditions of life as contrasted with aspiration or ideas of what ought to be; the latter being denoted by the term "standard of living". In the opinion of this Committee, there was no single index of the level of living as a whole that could be applied internationally. It suggested that the problem of levels of living be approached in a "pluralistic" manner, i.e., by analysis of various "components" representing internationally accepted values, and by the use of various statistical indicators for these components.

20.4 The component approach

In the view of the Committee, the following twelve components could be considered as an acceptable international catalogue of the components of the level of living, although the precise connotation of each would to some extent be determined by national attitudes and standards resulting from peculiarities in environmental conditions, cultures as well as in economic, political and social organization.

1. Health, including demographic conditions
2. Food and nutrition
3. Education, including literacy and skills
4. Conditions of work
5. Employment situation
6. Aggregate consumption and savings
7. Transportation
8. Housing, including household facilities
9. Clothing
10. Recreation and entertainment
11. Social security
12. Human freedoms

The Committee was of course aware that the proposed components did not include all the significant aspects of life which in their entirety would properly constitute the level of living. But they did include those aspects of living which are likely to be universally accepted as significant. The very first component in this list is "health, including demographic conditions". One of the reasons why it was placed first is that the data for this component are more easily obtained. In respect of many other components, as indeed for the health and demographic component also, the Committee was aware

that adequate data are not yet produced in most countries. One of the important sources of information to be tapped was what has been called "studies of the level of family living" — i.e., studies on a sampling basis of actual conditions of life as directly observed and recorded in family or household surveys. One of the major recommendations of the Committee was that uniform techniques and schedules of family living studies should be developed for use by governments, institutions and other interested bodies in different parts of the world. Another recommendation was that in respect of each of these twelve components numerical measures should be sought separately. The lead given by the United Nations has once again set health workers thinking how best to devise suitable measures of the state of the public health.

20.4.1 *The health and demographic component*

The term "health" has been defined by the World Health Organization as "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity". This definition is indeed wide, embracing physical, mental and social wellbeing. While health statisticians have devised several indices to compare some of the negative aspects of physical health, so far no suitable index has been put forward to quantify the status of a community's mental health or its state of social wellbeing. It would therefore seem a foregone conclusion that no single indicator to measure the level of the public health in such a broad sense is yet possible. Indeed, a study of the health and demographic components of levels of living raises several difficult and as yet unsolved problems, necessitating perhaps an examination of the many subcomponents of the health component itself. The purpose is not to measure such innumerable features as the term "health" presents — but to make at least a beginning. In other words, the present problem is to summarize briefly even though crudely the community health ev el in terms of numbers. We are thereby sacrificing detail but attempting at least to utilize the existing numerical information collected on the state of the community health. Thus on the one hand we may conceive of measuring defects, disabilities or diseases by a whole battery of indices depending on what special aspect is being examined — recognizing of course that absence of disease does not exhaust the possibilities of health. On the other hand, we may consider a community as one entity and seek to devise a single comprehensive index of its "healthiness". Statistical information would be needed to meet both approaches. The first approach requires highly detailed study and the diagnosis of community ill-health. The second approach should also use all the available statistical information but so condensed as to yield a single yardstick. In 1956, a WHO Study Group on Measurement of Levels of Health considered both aspects of this problem, distinguishing between comprehensive indicators of health and specific indicators of certain health aspects.

20.5 Propeortional mortality indicator

One comprehensive indicator has been put forward on the basis of

statistical investigation.[1] This is a simple indicator obtained as the percentage of deaths at ages 50 years and over to total deaths in the population (*proportional mortality indicator*).

Considered from an international viewpoint, the following criteria were laid down for selecting an indicator:

1. *Availability*: records should be available from as large a number of territories and countries as possible.
2. *Coverage*: the indicator should relate as far as possible to each country and territory as a whole and not to any selected area or population group only.
3. *Quality of basic data*: records needed to estimate the indicator should be of good quality, i.e., the indicator should not be unduly affected by qualitative defects in the records such as those arising from under-registration or from differences in registration practices, definitions, or procedures used for classifying and consolidating the data.
4. *Comprehensiveness*: the indicator should possess comprehensiveness of character as stipulated in the term "health, including demographic conditions". It implies that as far as possible various factors affecting health in the entire lifespan should be taken into account.
5. *Simplicity*: as far as possible the computation of the indicator should be simple enough to command international acceptance.
6. *Discriminatory power*: the indicator should possess high discriminatory power and validity so as to distinguish between countries at various levels of health and to indicate changes occurring from time to time.

The discriminatory power of the various health statistical indices in use was compared numerically. It was found to be poorest for the crude death rate, which is understandable because of peculiarities in the age and sex composition. Some developed countries, because of a large number of old people, may have a death rate higher than some underdeveloped countries. The infant mortality rate was found to be better for purposes of such discrimination, as also was the expectation of life. Among the various indices tested, it was found that proportional mortality of 50 years and over to the total deaths was the most discriminatory of all. The reasons why this proportion possesses the highest discriminatory value are not far to seek. Owing to the operation of past forces of mortality and natality, the demographic structures of countries vary. The population in the developed countries is in general older than in the underdeveloped countries, so that it is the underdeveloped countries that have a relative preponderance of persons under 50 years of age. Again, in the under-developed countries mortality rates are particularly high among infants, children and mothers. Thus, both the demographic structure of the population and the health conditions as reflected in the mortality pattern, combine to produce a relatively larger

[1] Proportional Mortality of 50 Years and Above; A Suggested Indicator of the Component "Health, Including Demographic Conditions" in the Measurement of Levels of Living, by S. Swaroop and K. Uemura. World Health Organization Bulletin, Vol. 17, pp. 439-481, 1957, Geneva.

number of deaths under 50 years in the under developed countries. Correspondingly, the deaths occurring at age 50 years and over are very much reduced. The better the health conditions, the nearer will the indicator be to 100.

Small differences in value would occur from varying degrees of under-registration, migration, etc. A broad grouping of the countries or territories on the basis of the average experience of the period 1949-53 is made below:

Broad grouping of countries according to proportional mortality indicator, 1949-53
(percentage of deaths 50 years and over to total deaths)

75 and over	50—74	25—49	Under 25
Sweden	Iceland	Yugoslavia	Peru
England & Wales	Canada	Iraq	Colombia
Norway	Finland	Brazil	Philippines
Denmark	Italy	Paraguay	Bolivia
Scotland	Union of South Africa	Puerto Rico	Jordan
Switzerland	Greece	Chile	Pakistan
New Zealand	Hungary	Morocco (Spanish zone)	Dominican Repubcli
Belgium	Uruguay	Panama	El Salvador
Luxembourg	Spain	China (Taiwan)	Nicaragua
N. Ireland	Czechoslovakia	Ceylon	Honduras
France	Lebanon	Costa Rica	Egypt
Australia	Bulgaria	Korea (Rep. of)	Guatemala
Austria	USA (non-white)	Venezuela	
Netherlands	Israel	Thailand	
USA (white)	Argentina	Malaya (Fed. of)	
Ireland	Portugal	India	
Germany (Fed. Rep.)	Japan	Mexico	
	Poland	Burma (Towns)	

The following Fig. 20.5, shows how the values of annual proportional mortality indicator have increased in 10 countries during 1920 to 1955.

This indicator compares favourably with the others for several reasons: records are available from a large number of countries; population data are not required at all; there are no problems of classification, except at age 50; and this indicator possesses a kind of stability which is not disturbed even by poor quality of registration and age classification. Indeed, for the study of trends it has an advantage, because unlike the expectation of life figures, which are calculated every 10 years, it can be calculated even on an annual or short-term basis. It is not a perfect indicator, but perhaps in the present state of knowledge, could be used for studying levels as well as trends.

20.6 Expectation of life

Expectation of life has a comprehensive character, because it summarizes the mortality experience at all ages of life and avoids to some extent the problems associated with age distribution of population. But the figure is not available for many countries and territories in the world, and is not usually calculated for smaller areas within the country. It is obtainable at some 10-year intervals only, related generally to censal periods ordinarily coming every 10 years. It would be suitable for comparisons only over long periods of time. This consideration might limit its usefulness from the standpoint of

ANNUAL PROPORTIONAL MORTALITY INDICATOR FOR CERTAIN COUNTRIES, 1920-1950

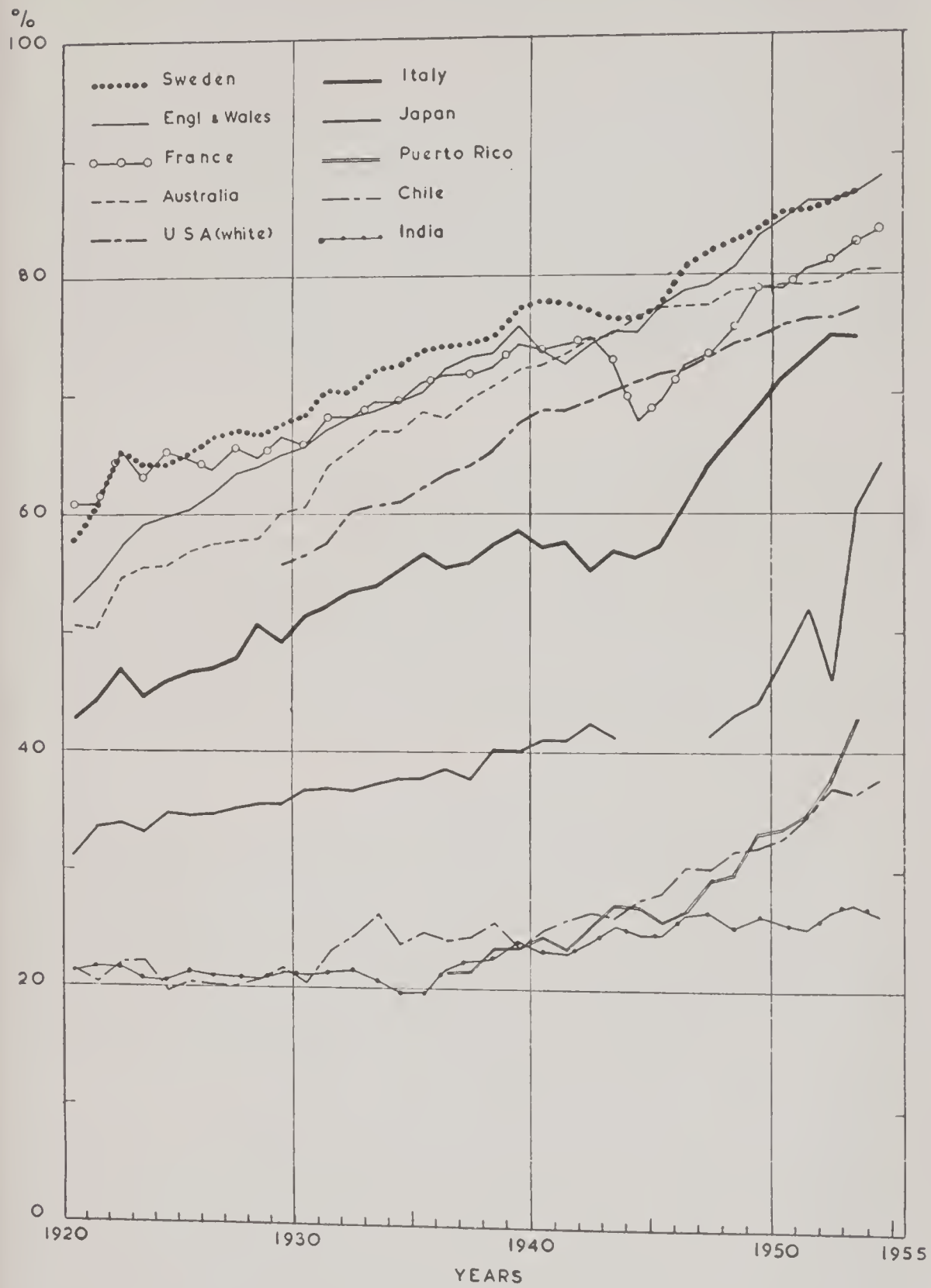


Fig. 20.5

public health action. Some refinements in the use of the expectation of life figures have been suggested. For instance, it has been argued that since the expectation of life at age 0 is considerably influenced by the infant mortality rate itself, we should study separately the expectation of life at age 1 year along with the infant mortality rate.

20.7 Crude death rate

The crude death rate may in some cases be the only indicator that can be obtained, even though it is deeply influenced by age composition of the population and therefore could not be used except for comparisons over short periods of time. Many methods of refining the crude death rates or summarizing the death rates first calculated separately for various age-groups have been suggested. Some make use of standard populations, some compute the number of working years lost by death, and others depend upon the use of weighting factors at various ages (see Section 14.4.7).

20.8 Specific indicators

Among the specific indicators should be mentioned the infant mortality rate and in particular the *late* infant mortality rate, i.e., covering the age from 1 month to under 12 months, because it is less influenced by prenatal and intranatal causes of death. The death rate from communicable diseases is useful but because medical certification of causes of death is not reliable in many areas, its usefulness is rather limited for the purpose of measuring levels of health. Alternatively, the total death rate in the 1 year to under five year age group has also been suggested as an indicator where the accuracy of age recording justifies its use.

20.9 Indicators based on morbidity data

The indicators mentioned so far can be derived from existing statistical data, but they all relate to mortality experience. No indicator directly related to morbidity has so far been proposed, owing to lack of comparable material in most countries. We know that in many countries national sample surveys on morbidity have already been undertaken and it is felt that this development should certainly lead to finding suitable indicators based on morbidity data. There is, for instance, the possibility of studying sickness absenteeism in school children. Further possibilities are in respect of nutrition, and the development of the child from 1 to 4 years.

While recognizing the importance of designing indicators for the direct measurement of health, one feels that for the present some working indicators have to be sought in deviations from health which are susceptible of measurement. Nevertheless, the subject of direct measurement of health is important and must take a prominent place in any programme of further study. Some of the possible health indicators capable of being used for the measurement of levels of health have been reviewed, especially those which are based on statistics already available in many countries. Clinical and laboratory exam-

ination of the people in the area would further add to the value of the data.

We are obliged for the time being to use vital statistical data in evolving suitable indicators of health. But looking ahead and considering the active interest of the United Nations and its specialized agencies, WHO and ILO, in standardizing methodology for the study of health at the family level, by means of sample surveys, it is hoped that health statisticians may be able to develop an index of health based on morbidity data. Many countries have taken steps to initiate sample studies on the levels of living with family or household as the unit. An extensive plan for a National Health Survey is already in operation in the United States.

Pioneering work has been done in the United States by Halbert L. Dunn to advance the concept of "High-level wellness for man and society" and the possibility of its measurement.[1] The experience gained from these efforts will determine the best method of obtaining the required information and discovering suitable indicators of health.

[1] Report on the possibility of measuring positive health. Prepared by an Ad Hoc Committee of the US National Committee on Vital and Health Statistics. Doc. N.C. 261, Washington 25, D.C.

CHAPTER 21

Evaluation in Public Health

21.1 Introduction

Statistics have been described as the "book-keeping" of public health departments and in this process the statistician has frequently to undertake the task of striking the "balance sheet". This is what evaluation does. In its publication, "What's the Score", the Committee on Administrative Practice of the American Public Health Association lists under the heading, "Why Evaluate?" a number of significant reasons which support evaluation as a community and health staff necessity. Some of these are:

Every progressive community wants to know:

What are we getting for our health dollar? Are we penny-wise and dollar-foolish? Are we spending enough on health?

What are our major health needs? Are they being met? If not, what should we do?

What about our facilities? Are they adequate? Are they modern?

Is our health department understaffed? If so, what is the cost in human life and health?

Do voluntary agencies, schools, and the health department co-operate? If not, why not?

How do we compare with other communities? What do they have that we don't? How do we stack up against prevailing standards?

What is more, evaluation can serve the health office as:

(a) A footrule for measuring future progress.

(b) A means of in-service training of staff members of both official and voluntary agencies.

(c) The material for making a budget.

(d) A link for joining official and voluntary agencies.

(e) A spring and stream for publicity and health education.

(f) A basis for annual reports.

(g) A means of comparing local health services with those of health units elsewhere.

(h) A flag to encourage better record keeping.

A periodic evaluation of the health of the community should be the core of every health programme. Frequently it is on the thoroughness of this appraisal that the future plan of work has to depend. If, for instance, it is shown that after years of an intensive treatment plan for hookworm the number of new cases has not shown any appreciable decrease, a fresh approach to its prevention will be necessary. Did the opening of maternity and

child welfare centres bring down the maternal and infant death rates? If not, where did the defect lie? If mass vaccination campaigns against smallpox did not eradicate the disease, let us find the reason why. These are straightforward cases. Sometimes we need to study the progress of individual disease control or individual programmes of action, and sometimes make an estimate of the entire health work in the area. This comparison may relate to the past of the same area or to a more advanced one. In other words, periodic assessment should serve to show up the weak points in a programme and inspire action for swifter preventive effort. In certain cases evaluation becomes all the more necessary as, for instance, when a health demonstration area is set up. A health demonstration *per se* means a comparison of the past with the present.

In connexion with programme evaluation, Volkenburgh states that business and industry have long practised and succesfully developed self-appraisal in the control and planning of their operations. With them it is a routine. In the public health services the record so far is not impressive. Public health also has become big business and now assumes the responsibilities of business. This demands inventory, evaluation and justification of each health programme in terms of specific results achieved and the needs and wishes of the community. Today, soaring taxes to meet new and expanding governmental services demanded by the people are resulting in a closer scrutiny of public health expenditure. The casual citation of low or improved morbidity and mortality rates, the gross number of visits made by nurses, or lectures given on the principles of disease prevention are no longer enough to justify the renewal of any public health appropriation. The survival and expansion of health services are increasingly dependent upon ability to demonstrate to the public and to appropriating bodies, through appraisal and analysis, that each type of public health programme is needed, and is worth while.

21.2 Terminology

Several terms are used for assessments, such as *evaluation*, *appraisal*, *inventory* or *survey*. All relate to the process or technique of assessing a community's health status from data collected in advance, the underlying purpose being to find a numerical expression for progress made.

Evaluation implies putting together information in numerical terms for relative comparisons. The term "evaluation" is also used (but less accurately) in a more general sense: to evaluate the performance as well as the measure of performance, and to evaluate the tools of measurement. We may evaluate a technique, a research project, a study, an activity, an objective, a purpose or a total programme. One of the aims of evaluation is to discover new facts and their correct interpretation and to revise accepted views or theories in the light of such newly discovered facts or by the practical application of new or revised conclusions. The term "evaluation" has been compared with the word "research". It is important that evaluation comes into the designing and development of a programme instead of trying to undertake the gene-

rally impossible task of assessing a programme in retrospect.

In this connexion the following four developments which may seem to be loosely related should be considered:

(a) carrying out comprehensive health surveys;
(b) designing evaluation schedules;
(c) cataloguing indices for the appraisal of health status and related factors;
(d) continuous evaluation procedure integrated with the programme activity.

They are interrelated, the underlying object in each case being to study the health set-up and provide a technique for the purpose of comparing numerically the health pictures with one another.

21.3 Evaluation by comprehensive health surveys

In a comprehensive health survey emphasis is placed on obtaining a sound understanding of the various factors (environmental, social, cultural, economic, educational, etc.) likely to impinge, favourably or adversely, on health work. It is an administrative tool for providing answers to many public health perplexities as well as supplying a greater sense of satisfaction in the work.

A number of surveys have been undertaken in several countries, those in the United Kingdom and the United States dating back a century or more. Often they originated from curiosity on the part of serious-minded, farsighted people who were not content with existing conditions and wanted to etablish an improved and more balanced health service. The classical example is the survey undertaken by Lemuel Shattuck in the city of Boston in 1845. In 1876 John Billings prepared an extensive survey schedule directly planned on a diversity of subjects such as water supply, drainage, disposal of garbage and excreta, gas and lighting, fire establishments, alarms, cemeteries, prisons, climate and topography — a far too ambitious schedule for those times. A number of surveys which followed in different towns led to various types of corrective action in connexion with child hygiene, water and milk sanitation, sewage disposal, etc. Further developments have taken place under the auspices of the Russell Sage Foundation, the Commonwealth Fund and the Milbank Memorial Fund, as well as national governments, public health associations, and teaching institutions. These experiences have led to improvements in technique and have demonstrated the usefulness of sound statistical and business or administrative procedures for securing reliable information on public health programmes. In recent years the use of sampling techniques has further stimulated surveys at the family level.

21.3.1 *Scope and conduct of comprehensive health surveys*

The specific objects of a comprehensive public health survey should cover the assembling, analysis and interpretation of accurate scientific data for one or more of the following purposes:

(a) to ascertain local health problems and, in particular, to determine in terms of the internationally accepted vital and health statistical indices the characteristics and prevailing level of community health. This will draw a base-line for measuring any change in the health status brought about by the programme;
(b) to recommend priorities in public health action;
(c) to make an inventory of the facilities and resources already available for instituting a health programme so that skills and resources can be properly deployed for the major health demonstration programme or for individual projects;
(d) to elicit information about the various demographic factors suspected of having a direct or indirect bearing on health, that is, to provide a "public health diagnosis";
(e) to serve as a guide to more intensive investigation into some local situation or problem;
(f) to appraise the result of health activities;
(g) to demonstrate the economic values of proposed health programmes and so inform leaders of public opinion, administrators and the people of needs, opportunities and advantages;
(h) to meet some local situation of an urgent or temporary nature;
(i) to secure co-operation and intelligent understanding of health effort before the public health programme is launched, and finally,
(j) to provide an historical record of a community health experience and programme.

A socio-economic or hospital survey to gauge the facilities needed could be coupled with the health survey of the area. A comprehensive survey will then determine the economic loss in manpower and in productivity through preventable ill-health. Other important pieces of information collected will be on the number of infants, pregnant women, disabled and bedridden population, as well as the sickness level, and the gaps in existing services. This will be the basis of all domiciliary health services and of individual health and mental care.

21.3.2 *Procedures for surveys*

Three procedures usually adopted are:

(a) a survey by the existing community organization, i.e. by the local executives, health council, community or social agencies;
(b) a survey directed by a single outside expert and undertaken with the co-operation of local talent;
(c) a survey by a group of experts in various fields working in conference with local representatives and under a survey director to study in detail different problems. A detailed approach may be necessary if extensive reorganization is contemplated. In this, not only public health workers, but experts in sociology, economics and physical and biological sciences also take part.

A recent experiment in health surveys is to have them conducted by the

citizens themselves, health authorities serving only in a consultative capacity. Pertinent information is obtained by asking questions of everyone in the community through the use of a simple questionnaire. An excellent example is the Clinton County, Ohio, health survey.[1] In this survey, items on the questionnaire were decided upon by the citizens' committee and the questionnaire was completed by lay interviewers visiting each household. The report was published in attractive pamphlet form: the findings are set out in simple terms, such as:

> "Too many of our babies are miscarried and born dead . . ."
> "Our school children lack dental and medical examinations . . ."
> "Undulant fever is an immediate problem in this area . . ."
> "Our tuberculosis cases are not found early enough . . ."

The citizens are thus persuaded to evaluate for themselves the health needs of their community and how they may be satisfied. Citizen responsibility for community health — not health department responsibility alone — is the goal.

21.4 The development of the evaluation schedules

In 1914 Charles Chapin undertook the task of setting out some kind of *comparative rating* for the work being done by various States and prepared a rating sheet in the hope that it would point out the weak points in each State. He thus introduced the principle of comparative evaluation. It differed from the comprehensive survey method because of the greater need to convert findings into numerical expressions and this, in turn, called for setting up standards or normal values, and rating items to ensure comparability. He set up a table of desirable activities and assigned arbitrary values totalling one thousand points. In actual assessment, his final scores for various states in the United States varied from zero for one southern state to 745 for Massachusetts. Chapin's pioneer attempts provided the exploratory groundwork upon which so much later work has been based.

In 1925, a schedule called "Appraisal Form for City Health Work" was issued by the American Public Health Association for trial use, followed by an appraisal form for rural health in 1927. In July 1938 a combined form of 185 pages for both city and rural health work was issued under the title "Appraisal Form for Local Health Work".

The latest edition of the evaluation schedule was published in 1947. Its scope extends beyond the activities of the health department to include the *community health programme* as a whole, covering the activities of both the official and non-official agencies identifiable in any way with public health. It utilizes *indices of achievement* rather than the *amount of work* carried out. The number of visits and inspections as a measuring rod has been largely superseded. In their place are included measures recognized as equally

[1] Clinton County Health Survey. Health Council of Clinton County. Washington, Ohio, 1950.

practicable in all communities. For example, in the tuberculosis section is included an item of percentages of cases first coming to light through death certificates, because a good tuberculosis programme should find cases at an early stage in the disease while there is still time to do something constructive for the sufferer. A high percentage of cases first discovered from the death certificates admittedly represents poor performance. In the section on milk control the criterion is the number of pasteurizing plants approved by the health department and not the number of inspection visits that have been made.

Another departure is in the manner of rating a community. There is no scoring method in the schedule itself, although distinctions are made in the importance of the items. In earlier appraisal forms an accumulation of good scores for minor items could make up largely for a poor score in a single extremely important item, but the section on milk control is now marked poor if there is no pasteurization of the milk supply, even though most of the other items are rated well.

A companion document known as "*Health Practice Indices*" is issued presenting in chart form practices and achievements of each of several hundred communities in the country submitting filled out schedules to the American Public Health Association. Although the charts do not show the name of each community in the area, the Association does inform each community of its identifying number, so that its position on each chart may be found and the community can see itself in this mirror of nationwide public health practice.

The schedule is arranged in sixteen sections. In all sections there are questions asking for basic data from several of which useful indices are computed.

The use of this Evaluation Schedule has been recommended by the American Public Health Association after some decades of preparatory study. Even though it has limitations, the schedule has set in motion an evaluation process covering a community-wide programme.

The American Public Health Association requests the state and local health departments to send to the Association completed schedules relating to the preceding year, for grading and for compilation of data from which information is secured for the publication of the pamphlet "Health Practice Indices".

21.5 Indices for the appraisal of health status and related factors

A set of health indices for international use was first compiled by K. Stouman and I. S. Falk[1] on behalf of the League of Nations Health Organisation and the Milbank Memorial Fund in 1936. Their contribution is in fact an answer to the question: what information ought we to have in order to evaluate the state of the public health and the factors which affect it, and

[1] Health Indices. A study of objective indices of health in relation to environment and sanitation. Quart. Bull. Health Org. League of Nations, Vol. V, No. 4, December 1936, pp. 901-996.

how can this information be arranged in a logical and concise form? It was not claimed to be a final system for adoption by all countries but rather a draft plan to establish a classification of data for a more precise appreciation of health conditions than had been secured in the past. It emphasized the importance of bringing together in one place all pertinent information that so often appears in scattered documents.

The indices suggested by the Health Organisation of the League of Nations were meant for adoption at the same time for local, national and international use. The indices fall into three categories: (a) vitality and health; (b) environment; and (c) administrative activity.

The outlook of public health work has broadened, and today new indices are needed. They should no longer deal exclusively with births and deaths, but comprehend a far wider range of sickness on the one hand, and the corresponding public health action on the other. In the light of more recent experience, suggestions for useful indices have been made by the WHO Study Group on Measurement of Levels of Health.[1]

21.6 Programme evalution

In September 1955 the First US National Conference on Evaluation in Public Health was held in Michigan. The conference emphasized that programme evaluation requires the same meticulous skill and scientific methodology as the epidemiologist employs to obtain unbiased results in the study of disease. In evaluating techniques many elements must be measured, such as reliability, validity, yield, cost, and public acceptance. We no longer look at evaluation as a procedure to be gone through at the termination of any programme; the procedure is built into the programme plan so as to guide reconsideration of objectives and redirection of the undertaking. It constitutes an essential ingredient of programme design. Evaluation of local health work should therefore be incorporated in all health programme planning. It should be carried on continuously by the use of activity reports and critical indices; at regular intervals by some such device as the Evaluation Schedule; and occasionally for definite, major objectives by the survey method.

Evaluation should cover as many as possible of the different activities, the emphasis naturally shifting according to the stage of development reached. Statistical analysis should guide the main findings. Starting at the planning stage, i.e. with an assessment of the problem — the needs to be met and the results to be aimed at — statistical scrutiny proceeds to the appraisal of the most suitable methods and procedures to be employed. Evaluation is thus continued for the duration of the programme, assessing the efforts being made and their influence on the development of strategy for achieving the final aims, continuing the timing and phasing of activities, controlling operations and modifying them when a redefinition or change in direction becomes advisable. The intention is not only to evaluate the terminal achievements of the project but also to predict the trend and scope

[1] Wld Hlth Org. techn. Rep. Ser. No. 137, 1957, Geneva.

of the long-range activities to be carried out later on the basis of accumulated experience.

It has been emphasized that evaluation is not an end in itself, but rather a means for improving and reorientating the development of the programme. Incidentally, the use of sound objective methods promotes a scientific approach among the public health personnel and encourages their co-operation in proper data collection.

To summarize, the essential requirements for effective evaluation are:

1. The existence of a plan, scientifically prepared, setting forth clearly the aims and methods.
2. The fixing of a baseline as a measure against which to compare results.
3. The availability of staff properly trained in evaluation.
4. The establishment of a system for the collection and analysis of data.
5. The according of greater importance in the evaluation to the results than to the efforts expended.
6. The evaluation of *all* aspects of the programme, distinguishing
   firstly: activities and procedures that serve to determine the efficiency of personnel and services, or the validity of methods;
   secondly: objectives as they apply to partial phases of the programme;
   thirdly: the ultimate aims, and
   fourthly: any special aspects to be studied, as, for example, the economic and social effects.
7. The utilization of the results of evaluation at all levels.

CHAPTER 22

The Statistician in the Health Department

The functions of the statistician in public health departments, large and small, have been set out in some detail in this book. The methods they employ and the way they go about their task in providing the necessary statistical background for the operation of public health services have been fully considered. A good deal of attention has been given to the day-to-day work of the statistician and the type of forms and schedules that he employs. It has been made clear that the health statistician has also many special functions, including the preparation of reports on unusual occurrences like epidemics of communicable disease and on special subjects which are either delegated to him or undertaken on his own initiative. The various uses of health statistics in a modern department have been fully described and a special reference has been made in Section 1.8 to the uses of health statistics in departments of all sizes, and varieties of function.

As we approach the end of these chapters, we must inevitably wonder what kind of person the health statistician is — his background of training, his real position in the department which he serves, and, above all, the opportunities which are given to him to exert his influence directly and indirectly on the health and wellbeing of the people.

The health statistician must have high professional qualifications, but it is not necessary that these should include a medical degree. Basic training in statistics is much more closely associated with mathematics, not so much as a technical subject but rather as a philosophy. His approach to public health must inevitably come at a moderately late stage in his professional education; it is in a very real sense a special qualification which is grafted on to the root knowledge of the theory and practice of statistics. Health statistics must in this sense extend new branches of knowledge; and it is thus essential that the statistician should approach medicine and public health, not at first as a teacher, but as a student learning new disciplines and strange ways of thinking about mankind individually and in the group. It is true that much of his work in relation to a health department will be concerned primarily with the group and the community; nevertheless, many of his detailed investigations will deal personally with the individuals who make up these groups. The health statistician, like the doctor, has to learn a great deal about what has often been called the doctor-patient relationship. Many of his investigations will depend for their success on the close and accurate questioning of individuals and households, and the health statistician and his staff must, therefore, be quick to recognize that the human approach is of vital signifi-

cance. He will find that he stands in a special relationship to the people, because much of his information will be strictly confidential and most of his work will depend on the understanding and active co-operation of his "patients". He, also, has a profound "doctor-patient" relationship.

We have also to consider the health statistician in relation to the service as a whole. Ideally, the health statistician should be wholly in charge of his own department under the general supervision of the health officer. Large departments will, of course, be provided mainly at national, state, and regional levels; smaller sections may be attached to local health departments, but should be under the direct supervision of the health statistician of regional or higher level. In relation to the health department as a whole, the health statistician should recognize three main theoretical functions, however he may decide to organize them in detail. The first of these may be described as the routine function of helping the health officer to run a competent service; he provides the health officer with the necessary statistical information, and deals with the administration of his own department or section in relation to the organization as a whole. These functions are well understood, and it is fully appreciated that the health statistician is neither an autocrat nor a servant, but a colleague. It should be particularly noted that he is a *professional* colleague and should therefore have ready access to all branches, and all documents that are concerned with the department of public health.

Secondly, the statistician is by his training and experience a research worker. It is his privilege and function, in co-operation with his colleagues, to undertake and organize research within his own sphere. This may be related to the duties carried out by one department or another in which he sees the need for better information or for the closer study of existing data. On the other hand, he may with the assistance of his own staff, initiate and carry out a programme of pure research, that is, without a direct relationship to the work which he is undertaking as part of his official duty. It cannot be too clearly stated, however, that the duty of helping on the departmental work is a primary function and ought not to be overcast by the demands of research. Day-by-day duties have an unchallengeable priority.

In the third place, it is the great privilege of the health statistician, as a trained professional worker, to put forward ideas, to initiate developments and to encourage his colleagues in other spheres of activity to use his statistical services in any enquiries which they may wish to undertake. It has sometimes been suggested that one of the main functions of the health statistician (which in some cases he carries out only too well) is criticism, often of a sharply negative quality. In point of fact his main function is encouragement. It is true that he has a right and duty to criticise investigations that are not carried out with sufficient accuracy, or with precautions against fallacies, but the health statistician who has a real sense of team work learns how to make his office a resort of team workers in every field of public health, and indeed, of many other subjects such as management and administration — a place where they know they will be welcomed with friendly and shrewd criticism and full ma easure of encouragement.

TABLE I ANNUAL CRUDE BIRTH RATE AND CRUDE DEATH RATE FOR FINLAND AND SWEDEN AND INFANT MORTALITY RATE FOR SWEDEN BEFORE 1800

Year	Crude birth rate per 1000 population		Crude death rate per 1000 population		Infant mortality per 1000 live births
	Finland	Sweden	Finland	Sweden	Sweden
1749	.	34.2	.	28.0	.
1750	.	36.8	.	27.0	.
1751	44.3	39.0	24.6	26.4	186.0
1752	44.7	36.3	26.3	27.6	222.3
1753	44.1	36.5	26.1	24.3	189.5
1754	46.4	37.6	35.1	26.6	205.6
1755	46.9	37.9	30.7	27.7	225.4
1756	45.8	36.5	36.3	28.0	219.9
1757	43.3	33.0	26.2	29.9	220.9
1758	42.3	33.8	29.5	32.4	208.7
1759	44.5	34.1	28.1	26.3	189.7
1760	46.6	36.3	27.9	24.8	179.2
1761	45.8	35.3	28.3	25.8	208.9
1762	41.3	35.5	29.6	31.2	239.2
1763	43.0	35.3	41.0	33.2	240.3
1764	45.7	34.9	33.1	27.4	207.3
1765	42.9	33.6	29.7	27.8	212.3
1766	41.5	34.0	28.6	25.2	208.7
1767	40.7	35.6	29.1	25.7	198.7
1768	42.9	33.8	25.8	27.3	219.5
1769	42.4	33.3	28.3	27.3	216.7
1770	40.9	33.2	30.2	26.2	208.9
1771	38.0	32.4	26.1	27.9	210.9
1772	37.6	29.0	23.9	37.6	239.3
1773	37.9	25.6	21.5	52.6	285.8
1774	40.3	34.5	21.5	22.4	167.2
1775	40.4	35.7	25.6	24.9	184.7
1776	39.0	32.9	30.5	22.5	173.8
1777	40.1	33.0	32.0	24.9	195.1
1778	42.7	34.8	25.0	26.6	211.3
1779	43.2	36.7	21.9	28.5	214.7
1780	41.2	35.7	21.1	21.7	164.0
1781	37.7	33.5	26.5	25.6	192.4
1782	41.7	32.0	25.1	27.3	187.7
1783	40.0	30.3	31.2	28.1	202.4
1784	42.7	31.5	25.3	29.7	195.3
1785	39.8	31.4	30.3	28.3	192.6
1786	39.9	33.0	26.3	26.0	202.0
1787	40.4	31.6	23.7	24.1	186.7
1788	36.1	34.1	33.3	26.4	207.2
1789	34.2	32.4	37.7	32.2	223.6
1790	37.0	30.9	38.1	29.4	208.6
1791	36.0	33.0	40.9	25.8	187.3
1792	42.2	36.9	25.0	24.1	192.8
1793	43.8	34.6	25.6	24.4	199.9
1794	41.4	33.9	32.0	23.7	180.6
1795	42.1	32.1	23.6	28.0	202.4
1796	39.7	34.7	23.4	24.7	193.2
1797	41.2	34.8	20.2	23.8	195.8
1798	38.6	33.7	22.0	23.1	183.7
1799	38.7	32.0	27.6	25.2	190.7
1800	37.6	28.7	25.5	31.4	239.7

TABLE II ANNUAL CRUDE BIRTH RATE PER 1000 POPULATION IN CERTAIN COUNTRIES, 1801 - 1850

Year	Belgium	Denmark	England & Wales	Finland	France	Netherlands	Norway	Sweden
1801	.	31 1	.	39.6	.	.	27.7	30 0
1802	.	32.1	.	39.2	.	.	27.6	31.7
1803	.	32.9	.	35.6	.	.	28.9	31.3
1804	.	32.3	.	39.1	.	.	27.7	31.9
1805	.	32.8	.	38.4	.	.	29.2	31.7
1806	.	30.2	.	35.7	31.4	.	29.6	30 7
1807	.	30 9	.	36.2	31.8	.	29.0	31.2
1808	.	30.5	.	30.4	31.3	.	26.9	30.5
1809	.	28.7	.	28.6	32.0	.	22.2	26.8
1810	.	29.7	.	40.5	31.8	.	28.3	33.2
1811	.	29.8	.	36.4	31.8	.	26.7	35.6
1812	.	29.0	.	38.9	30.1	.	29.1	33.8
1813	.	28.1	.	35.6	30.5	.	25.6	29.9
1814	.	29.5	.	36.7	33.9	.	24.2	31.8
1815	.	32.9	.	37.5	32.5	.	29.9	34.8
1816	.	31.9	.	38.8	32.9	.	35.1	35.2
1817	.	31.9	.	39.0	31.8	.	32.5	33.4
1818	.	31 4	.	38.5	30.6	.	30.8	33.8
1819	.	31.9	.	36.1	32.9	.	31.9	33.0
1820	.	31.1	.	36.6	31.7	.	33.3	33.0
1821	.	31.7	.	41.4	31.7	.	34.7	35 4
1822	.	33.4	.	35.6	31.7	.	32.9	35.9
1823	.	32.5	.	40.3	31.2	.	33.9	36.8
1824	.	31.4	.	37.8	31.6	.	32.5	34.6
1825	.	31.5	.	38.5	31.0	.	34.3	36.5
1826	.	31.7	.	37.6	31.4	.	34.8	34.8
1827	.	29.6	.	36.7	30.8	.	32.0	31.3
1828	.	30.6	.	39.3	30.5	.	31.8	33.6
1829	.	29.9	.	38.7	30.0	.	33.6	34.9
1830	32 3	29.0	.	36.6	29.9	.	32.3	32.9
1831	33.0	29.6	.	35.2	30 3	.	31.0	30 5
1832	31.5	26.7	.	34.5	28.6	.	29.9	30.9
1833	33 2	32.0	.	30.2	29.5	.	30.7	34.1
1834	33.3	33.0	.	36.6	29.8	.	31.7	33.7
1835	34.0	31.6	.	34.3	29.9	.	32.6	32.7
1836	34.0	30.3	.	31.1	29.2	.	29.4	31 8
1837	33.4	29.8	.	31.6	28.0	.	28.7	30.8
1838	35.2	29.5	30.3	31.8	28.5	.	27.7	29 4
1839	33.7	28.9	31.7	33.7	28.2	35.6	26.7	29.5
1840	34.2	30.4	31.8	34.7	27.9	32.8	27.8	31.4
1841	34.0	29.7	32.2	34.0	28.5	35.5	29.8	30 3
1842	32.6	30.0	32.1	37.2	28.5	34.2	30.7	31.7
1843	31 9	29.8	32.3	35.8	28.2	33.7	30.2	30.8
1844	31.8	30.3	32.6	35.0	27.5	34.3	29.9	32.2
1845	32.2	30.7	32.5	35.7	27.9	34.2	31.2	31.5
1846	27.8	30.1	33.8	33.2	27.3	31.4	31.1	29.9
1847	27 2	30.6	31.5	33.9	25.4	28.6	30.8	29.6
1848	27.7	30.6	32.4	36.5	26.5	30.1	29.8	30 3
1849	31.0	31.0	32.9	37.5	27.7	34.2	32.0	32.8
1850	30.0	31.5	33.4	35.7	26.8	35.1	31.0	31.9

TABLE III ANNUAL CRUDE BIRTH RATE PE

Year	EUROPE									
	Belgium	Denmark	England & Wales	Finland	France	Ireland	Italy	Netherlands	Norway	Port.
1851	30.3	30.1	34.2	38.2	27.1	.	.	35.2	31.9	
1852	30.0	33.2	34.2	35.0	26.8	.	.	35.0	31.0	
1853	28.3	31.6	33.3	35.1	26.0	.	.	33.1	32.0	
1854	28.8	32.7	34.1	37.5	25.5	.	.	32.8	34.3	
1855	27.7	32.0	33.7	35.8	25.0	.	.	32.1	33.4	
1856	29.1	32.4	34.4	38.3	26.3	.	.	32 8	32.2	
1857	31.8	33.0	34.4	32.8	25.9	.	.	34.7	33.0	
1858	31.7	33.2	33.7	36.5	28.7	.	.	32.4	33.5	
1859	32.4	33.8	35.0	35.8	27.9	.	.	35.0	34.8	
1880	31.0	32.7	34.3	36.4	26.2	.	.	31.9	33.3	
1861	31.1	31.8	34.6	37.8	28.9	.	.	35.4	30.7	
1862	30.4	31.0	35.0	37.3	26.5	.	.	33.2	32.1	
1863	32.2	31.1	35.3	36.2	26.9	.	39.2	36.4	32.7	
1864	32.1	30.3	35.4	39.3	26.6	24.0	37.9	35.7	31.9	
1865	31.8	31.4	35.4	34.2	26.5	25.7	38.5	36.1	31.9	
1868	31.7	32.2	35.2	32.0	26.4	28.2	39.0	35.4	31.9	
1867	32.6	30.5	35.4	32.3	26.4	26.0	36.7	35.4	29.9	
1868	31.9	31.2	35.8	24.6	25.7	26.8	35.4	34.9	30.0	
1869	32.0	29.5	34.8	33.7	25.7	28.7	37.2	34.3	28.6	
1870	32.7	30.5	35.2	38.3	25.5	27.7	36.9	36.1	29.1	
1871	31.2	30.2	35.0	37.3	22.9	28.1	37.0	35.4	29.3	
1872	32.7	30.3	35.6	36.4	26.7	27.8	38.0	36.0	29.8	
1873	33.0	30.8	35.4	37.0	26.0	27.1	36.4	36.2	30.0	
1874	33.1	30.9	36.0	37.9	26.2	26.6	35.0	36.4	30.8	
1875	32.9	31.9	35.4	36.6	25.9	26.1	37.8	36.6	31.3	
1876	32.7	32.6	36.3	36.7	26.2	26.4	39.3	37.1	32.0	
1877	32.8	32.4	36.0	38.2	25.5	26.2	37.1	38.6	32.0	
1878	31.9	31.7	35.6	35.4	25.2	25.1	36.3	36.1	31.3	
1879	31.9	32.0	34.7	37.8	25.1	25.2	37.9	36.7	32.2	
1880	31.0	31.8	34.2	36.5	24.6	24.7	34.0	35.5	30.9	
1881	31.8	32.3	33.9	35.0	24.9	24 5	38.1	35.0	30.5	
1882	31.6	32.4	33.8	36.3	24.8	24.0	37.2	35.3	31.0	
1883	30.9	31.8	33.5	35.9	24.8	23.5	37.2	34 3	31.1	
1884	30.9	33.4	33 6	36.1	24.7	23.9	39.0	34.9	31.2	
1885	30.3	32.6	32.9	34.2	24.3	23.5	38.6	34.4	31.5	
1886	29.9	32.6	32.8	35.3	23.9	23.2	37.0	34.6	31.1	31
1887	29.7	32.0	31.9	36.2	23.5	23.1	39.0	33.7	31.0	33
1888	29.4	31.7	31.2	34.6	23.1	22.8	37.5	33.7	31.0	33
1889	29.4	31.3	31.1	33.4	23.0	22.7	38.3	33.2	29.9	33
1890	29.0	30.8	30.2	32.9	21.8	22.3	35.8	32.9	30.3	32
1891	30.0	30.9	31.4	34.3	22.6	23.1	37.2	33.7	30.9	32
1892	28.9	29.5	30.4	31.5	22.3	22.5	36.2	32.0	29.6	31
1893	29.5	30.5	30.7	29.9	22.8	23.0	36.5	33.8	30.7	31
1894	29.0	30.1	29.6	30.8	22.3	22.9	35.5	32.7	29.8	29
1895	28.5	30.0	30.3	32.6	21.7	23.2	35.0	32.8	30.6	30
1896	29.0	30.3	29.6	32.1	22.5	23.6	34.8	32.7	30.4	30
1897	29.0	29.7	29.6	31.9	22.3	23.5	34.7	32.5	30.0	30
1898	28.8	30.2	29.3	34.0	21.8	23.2	33.5	31.9	30.3	30
1899	28.8	29.8	29.1	33.2	21.9	22.9	33 9	32.0	30.9	29
1900	28.9	29.8	28.7	32.0	21.4	22.7	33.0	31.5	30.1	30

ULATION IN CERTAIN COUNTRIES, 1851 - 1900

				AMERICA				ASIA	OCEANIA	
otland	Spain	Sweden	Switzerland	Argentina	Chile	Mexico	Uruguay	Japan	Australia	New Zealand
.	.	31.7	.	.	.	.	.	.	.	.
.	.	30.7	.	.	.	.	.	.	.	.
.	.	31.4	.	.	.	.	.	.	.	.
.	.	33.5	.	.	.	.	.	.	.	.
1 5	.	31.7	.	.	.	.	.	.	.	.
4.9	.	31.5	.	.	.	.	.	.	.	.
4 3	.	32.4	.	.	.	.	.	.	.	.
4.4	35 2	34 8	.	.	.	.	.	.	.	.
5.0	38 4	35 0	.	.	.	.	.	.	.	.
5.6	36.7	34.8	.	.	.	.	.	.	42.8	.
4 9	39 0	32.6	.	.	.	.	.	.	42.3	38.7
4 6	38 5	33.4	.	.	.	.	.	.	43.3	36 3
5.0	37 8	33.6	.	.	.	.	.	.	41.7	35.3
5.6	39 2	33.6	.	.	.	.	.	.	42.9	38.7
5 5	38.6	32.8	.	.	.	.	.	.	42.1	41.4
5.4	38.3	33.1	.	.	.	.	.	.	39.8	43.0
5.1	38.5	30.8	.	.	.	.	.	.	40.4	42.3
5.3	35.7	27.5	.	.	.	.	.	.	40.5	42.1
4.3	37.0	28.2	.	.	.	.	.	.	38.7	41.9
4 6	38.8	28.8	29.8	.	.	.	.	.	38.7	42.3
4.5	.	30.4	29.0	.	.	.	.	.	38.0	41.1
4.9	.	30.0	29.8	.	.	.	.	17.2	37.1	39.5
4.8	.	30.8	29.7	.	.	.	.	23.9	37.4	39.0
5.6	.	30.9	30.4	.	.	.	.	24.9	36.8	40.3
5.2	.	31.2	31.8	.	.	.	.	25.6	35.9	40.3
5.6	.	30.8	32.8	.	.	.	.	26.3	35.9	41.8
5.3	.	31.1	32.0	.	.	.	.	.	35.0	41.7
4.9	36.1	29.8	31.3	.	.	.	.	.	35.4	42.3
4.3	35.8	30.5	30.5	.	.	.	.	24.5	35.8	40.3
3.6	35.5	29.4	29.8	.	39.3	.	.	24.8	35.3	40.8
3.7	37.1	29.1	29.8	.	46.2	.	.	25.8	35.3	38.0
3.5	36.2	29.4	28.9	.	41.9	.	43.0	25.8	34.5	37.3
2.8	35.6	28.9	28.5	.	42.7	.	42.6	28.4	34.8	36.3
3 7	36.7	30.0	28.3	.	40.3	.	38.9	27.8	35.6	35.9
2.7	36.3	29.4	27.7	.	25.8	.	40.7	29.6	35.7	34.3
2.9	36.7	29.8	27.8	.	32.0	.	41.5	28.8	35.4	33.1
1.7	36.1	29.7	27.9	.	33.0	.	42.1	27.6	35.6	32.1
1.3	36.4	28.8	27.7	.	35.4	.	42.0	30.0	35.5	31.2
0.9	36.4	27.7	27.5	.	38.7	.	41.6	31.0	34.7	30.1
0.4	34.4	28.0	26.3	.	37.6	.	40.7	28.8	35.0	29.4
1.2	35.3	28.3	27.8	.	34.3	.	40.6	26.7	34.5	29.0
0.7	35.8	27.0	27.4	.	38.3	.	39.6	29.4	33.7	27.8
0.8	35.6	27.4	27.7	.	37.7	.	37.6	28.5	32.8	27.5
9.9	34.8	27.1	27.1	.	39.5	.	38.1	28.9	30.8	27.3
0.0	35.0	27.5	27.1	.	38.2	30.5	39.2	29.5	30.4	26.8
0.4	35.9	27.2	27.9	.	34.6	31.8	37.8	30.0	28.4	26.3
0.0	34.1	26.7	28.1	.	34.8	28.9	32.1	30.9	28.2	26.0
0 1	33.3	27.1	28.4	.	33.1	37.1	33.6	31.3	27.2	25.7
9.8	34.2	26.4	28.9	38.3	33.5	37.7	34.3	31.4	27.3	25.1
9.6	33.8	27.0	28.8	36.2	34.6	36.4	32.6	31.4	27.3	25.6

TABLE IV ANNUAL CRUDE BIRTH RATE PE

Year	EUROPE											
	Belgium	Denmark	England & Wales	Finland	France	Ireland[1]	Italy	Netherlands	Norway	Portugal	Scotland	
1901	29.4	29.7	28.5	32.5	22.0	22.7	32.5	32.3	29.6	31.1	29.5	
1902	28.4	29.2	28.5	31.5	21.7	23.0	33.3	31.8	29.0	32.0	29.2	
1903	27.5	28.7	28.4	30.4	21.1	23.1	31.4	31.6	28.8	33.1	29.2	
1904	27.1	28.9	27.9	31.8	20.9	23.6	32.5	31.4	28.1	32.1	28.6	
1905	26.2	28.4	27.2	30.6	20.6	23.4	32.3	30.8	27.4	32.2	28.1	
1906	25.7	28.5	27.2	31.3	20.9	23.6	32.1	30.4	26.4	32.1	28.6	
1907	25.3	28.2	26.5	31.2	20.0	23.2	31.7	30.0	26.1	30.7	27.7	
1908	24.9	28.6	26.7	30.7	20.5	23.3	33.7	29.7	25.9	30.3	28.1	
1909	23.7	28.2	25.8	31.2	19.8	23.5	32.8	29.1	25.9	29.9	27.3	
1910	23.7	27.5	25.1	30.1	19.9	23.3	33.3	28.6	25.8	31.8	26.2	
1911	22.9	26.7	24.4	29.1	19.0	23.2	31.5	27.9	25.7	38.7	25.6	
1912	22.6	26.6	24.0	29.1	19.1	23.0	32.4	28.1	25.3	34.8	25.9	
1913	22.4	25.6	24.1	27.2	19.0	22.8	31.7	28.3	25.1	32.1	25.5	
1914	20.4	25.6	23.8	26.9	18.1	22.6	31.0	28.3	25.1	31.1	26.1	
1915	16.1	24.2	21.8	25.4	11.8	22.0	30.5	26.3	23.5	32.0	23.9	
1916	12.9	24.4	21.0	24.1	9.5	21.0	24.0	26.6	24.2	31.5	22.9	
1917	11.3	23.7	17.8	24.3	10.4	19.8	19.5	26.2	25.1	30.7	20.3	
1918	11.3	24.1	17.7	23.8	12.1	20.0	18.1	25.0	24.6	29.3	20.5	
1919	16.3	22.6	18.5	19.2	13.0	20.0	21.4	24.4	22.7	27.6	22.0	
1920	22.1	25.4	25.5	25.3	21.4	22.2	31.8	28.3	26.1	33.7	28.1	
1921	21.8	24.0	22.4	24.3	20.7	20.2	30.6	27.4	24.0	32.6	25.2	
1922	20.4	22.2	20.4	23.4	19.3	19.5	30.8	25.9	23.2	33.6	23.5	
1923	20.4	22.3	19.7	23.7	19.1	20.5	30.0	26.0	22.6	34.1	22.9	
1924	19.9	21.8	18.8	22.4	18.7	21.1	29.0	24.8	21.2	34.1	22.0	
1925	19.8	21.0	18.3	22.3	19.0	20.8	28.4	24.2	19.7	32.4	21.4	
1926	19.0	20.5	17.8	21.7	18.8	20.6	27.7	23.8	19.4	33.0	21.1	
1927	18.3	19.6	16.7	21.1	18.2	20.3	27.5	23.1	17.9	30.3	19.9	
1928	18.4	19.6	16.7	21.5	18.3	20.1	26.7	23.3	17.8	31.7	20.0	
1929	18.3	18.6	16.3	20.9	17.7	19.8	25.6	22.8	17.3	29.8	19.2	
1930	18.8	18.7	16.3	20.6	18.0	19.9	26.7	23.1	17.0	29.9	19.6	
1931	18.3	18.0	15.8	19.5	17.5	19.5	24.9	22.2	16.3	29.6	19.0	
1932	17.8	18.0	15.3	18.7	17.3	19.1	23.8	22.0	16.0	29.8	18.6	
1933	16.6	17.3	14.4	17.4	16.2	19.4	23.8	20.8	14.8	28.9	17.6	
1934	16.1	17.8	14.8	18.0	16.2	19.5	23.5	20.7	14.6	28.4	18.0	
1935	15.5	17.7	14.7	18.5	15.3	19.6	23.4	20.2	14.4	28.3	17.8	
1936	15.3	17.8	14.8	18.1	15.0	19.6	22.4	20.2	14.6	28.2	17.9	
1937	15.4	18.0	14.9	19.9	15.0	19.2	22.9	19.8	15.0	26.7	17.6	
1938	16.0	18.1	15.1	21.0	14.9	19.4	23.8	20.5	15.4	26.6	17.7	
1939	15.5	17.8	14.8	21.2	14.8	19.1	23.6	20.6	15.8	26.2	17.4	
1940	13.6	18.3	14.1	17.8	14.0	19.1	23.5	20.8	16.1	24.3	17.1	
1941	12.1	18.5	13.9	24.2	13.4	19.0	20.9	20.3	15.3	23.7	17.4	
1942	13.2	20.4	15.6	16.6	14.8	22.3	20.5	21.0	17.7	23.8	17.5	
1943	15.0	21.4	16.2	20.4	15.9	21.9	20.0	23.0	18.9	24.9	18.2	
1944	15.3	22.7	17.7	21.2	16.4	22.2	19.3	24.0	20.4	25.0	18.4	
1945	15.7	23.6	15.9	25.3	16.5	22.6	18.5	22.6	20.0	25.7	16.8	
1946	18.3	23.4	19.2	27.7	20.8	22.9	22.7	30.2	22.6	25.0	20.2	
1947	17.8	22.1	20.5	28.0	21.4	23.2	22.2	27.8	21.4	24.5	22.0	
1948	17.6	20.3	17.8	27.5	21.2	22.1	21.9	25.3	20.5	26.7	19.4	
1949	17.2	18.9	16.7	26.1	21.1	21.5	20.3	23.7	19.5	25.5	18.5	
1950	16.9	18.6	15.9	24.5	20.7	21.3	19.6	22.7	19.1	24.4	18.0	
1951	16.4	17.8	15.5	23.0	19.7	21.3	18.4	22.3	18.4	24.5	17.7	
1952	16.7	17.8	15.3	23.1	19.4	21.9	17.9	22.4	18.8	24.7	17.7	
1953	16.6	17.9	15.5	21.9	18.9	21.2	17.7	21.8	18.7	23.4	17.8	
1954	16.8	17.3	15.2	21.4	18.9	21.2	18.2	21.6	18.5	22.7	18.0	
1955	16.8	17.3	15.0	21.2	18.6	21.2	18.1	21.4	18.5	23.9	18.0	
1956	16.8	17.2	15.7	20.7	18.5	21.0	18.1	21.2	18.5	22.9	18.5	

[1] Excluding Northern Ireland from 1922 onwards

PULATION IN CERTAIN COUNTRIES, 1901-1956

		AMERICA					ASIA		OCEANIA		Year
8weden	Switzerland	Argentina	Chile	Mexico	Uruguay	USA[1]	India[2]	Japan	Australia	New Zealand	
27.0	29.1	35.8	35.9	34.8	32.9	.	34.6	32.7	27.6	26.3	1901
26.5	28.7	34.8	35.7	33.7	31.8	.	39.4	32.8	27.1	25.9	1902
25.7	27.7	35.3	34.0	31.7	32.0	.	39.0	32.0	25.3	26.6	1903
25.7	27.7	34.0	35.4	32.4	27.6	.	40.9	30.6	28.7	26.9	1904
25.7	27.4	34.0	35.1	34.0	33.9	.	39.1	30.6	26.7	27.2	1905
25.7	26.9	33.1	36.8	32.2	32.3	.	37.4	28.8	26.6	27.1	1908
25.5	26.2	.	38.8	32.8	32.9	.	37.7	32.9	26.8	27.3	1907
25.7	26.4	.	39.7	34.3	34.2	.	37.7	33.7	26.6	27.5	1908
25.6	25.5	.	39.1	34.0	33.3	.	38.8	33.9	28.7	27.3	1909
24.7	25.0	38.3	38.8	32.0	32.4	.	39.5	33.9	28.7	26.2	1910
24.0	24.2	37.9	39.4	.	32.6	.	38.6	34.0	27.2	26.0	1911
23.8	24.2	38.6	39.5	.	33.1	.	39.0	33.3	28.6	26.5	1912
23.2	23.2	38.0	40.4	.	33.0	.	39.4	33.2	28.2	26.1	1913
22.9	22.4	36.7	39.0	.	30.7	.	39.6	33.7	27.9	28.0	1914
21.6	19.5	35.3	38.6	.	29.5	25.0	37.8	33.0	27.1	25.3	1915
21.2	18.9	35.3	40.3	.	27.9	24.9	37.1	32.7	28.6	25.9	1916
20.9	18.5	33.6	41.1	.	27.0	24.5	39.3	34.3	26.3	25.7	1917
20.3	18.7	32.9	39.9	.	27.8	24.7	35.3	32.2	25.0	23.4	1918
19.8	18.6	32.7	39.2	.	27.4	22.4	30.2	31.6	23.5	21.4	1919
23.6	20.9	32.3	39.1	.	26.7	23.7	33.0	38.2	25.5	25.1	1920
21.5	20.8	32.7	39.2	.	28.2	24.2	32.2	35.1	25.0	23.4	1921
19.6	19.7	33.1	38.7	31.4	26.0	22.3	31.5	34.2	24.7	23.2	1922
18.9	19.4	34.0	39.5	32.0	25.4	22.1	34.5	34.9	23.8	22.0	1923
18.1	18.9	32.8	40.0	30.8	25.8	22.2	33.6	33.8	23.2	21.6	1924
17.6	18.5	31.8	39.8	33.1	25.4	21.3	32.8	34.9	22.9	21.2	1925
16.8	18.3	31.2	40.1	31.2	25.4	20.5	33.3	34.8	22.0	21.1	1926
16 1	17.5	30.7	42.8	30.5	24.6	20.5	33.8	33.6	21.8	20.3	1927
18.1	17.4	30.8	43.6	32.3	25.0	19.7	34.7	34.4	21.3	19.6	1928
15.2	17.1	30.2	41.9	39.3	24.2	18.8	33.1	33.0	20.3	19.0	1929
15.4	17.2	29.5	39.8	49.4	24.4	18.9	33.1	32.4	19.9	18.8	1930
14.8	16.7	28.5	34.6	43.8	23.3	18.0	34.5	32.2	18.2	18.5	1931
14.5	16.7	28.1	34.2	43.3	22.5	17.4	33.6	32.9	18.9	17.1	1932
13.7	16.4	26.1	33.4	42.2	21.0	18.8	35.4	31.6	16.8	16.6	1933
13.7	16.2	25.5	33.8	44.3	20.6	17.2	33.4	30.0	18.4	16.5	1934
13.8	16.0	25.2	34.1	42.3	20.4	18.9	34.3	31.6	16.6	16.2	1935
14.2	15.6	24.5	34.6	43.0	19.9	18.7	34.8	29.9	17.1	16.6	1936
14.4	14.9		32.3	44.1	19.9	17.1	33.7	30.8	17.4	17.3	1937
14.9	15.2	22.9	32.1	43.5	19.8	17.6	33.3	27.1	17.4	17.9	1938
15.4	15.2	22.9	33.3	44.6	20.1	17.3	32.7	28.6	17.6	18.7	1939
15.1	15.2	23.2	33.4	44.3	19.9	17.9	32.0	29.4	17.9	21.2	1940
15.6	16.9	23.0	32.6	43.5	20.4	18.8	32.1	31.1	18.9	22.8	1941
17.7	18.4	22.5	33.2	45.5	19.4	20.8	29.5	30.3	19.0	21.7	1942
19.3	19.2	23.6	33.1	45.5	19.6	21.5	26.1	30.3	20.6	19.7	1943
20.6	19.6	25.3	33.2	44.2	20.7	20.2	25.8	29.2	21.0	21.6	1944
20.4	20.1	25.2	33.3	44.9	.	19.5	28.0	23.2	21.7	23.2	1945
19.7	20.0	24.7	32.4	43.7	.	23.3	28.8	25.3	23.6	25.2	1946
18.9	19.4	25.0	36.0	45.3	.	25.8	26.4	34.3	24.1	28.5	1947
18.4	19,2	25.3	35.3	44.6	18.7	24.2	25.2	33.7	23.1	25.6	1948
17.4	18.4	25.1	34.7	44.7	18.7	23.9	26.4	32.8	22.9	25.0	1949
18.4	18.1	25.5	34.0	45.5	18.6	23.5	24.9	28.2	23.3	24.7	1950
15.6	17.2	25.2	33.9	44.6	18.5	24.5	24.9	25.4	23.0	24.4	1951
15.5	17.4	24.7	32.7	43.8	18.7	24.7	25.4	23.5	23.3	24.8	1952
15.4	17.0	25.0	34.6	45.0	18.7	24.6	24.8	21.5	22.9	24.1	1953
14.6	17.0	24.4	33.6	46.4	19.3	24.9	24.4	20.1	22.5	24.7	1954
14.6	17.1	24.1	35.0	46.4	12.2	24.6	27.0	19.4	22.6	24.9	1955
14.8	17.4	23.9	35.4	46.8	11.4	24.9	.	18.5	22.5	24.7	1956

1 Birth-registration States
2 Registration area. Excluding Burma from 1921

TABLE V ANNUAL CRUDE DEATH RATE PER 1000 POPULATION IN CERTAIN COUNTRIES, 1801-1850

Year	Belgium	Denmark	England & Wales	Finland	France	Netherlands	Norway	Sweden
1801	.	27.7	.	21.8	.	.	27.6	26.1
1802	.	23.1	.	22.3	.	.	24.9	23.7
1803	.	22.4	.	33.1	.	.	24.6	23.7
1804	.	23.7	.	25.0	.	.	23.2	24.8
1805	.	23.2	.	21.2	.	.	20.4	23.4
1806	.	22.3	.	21.9	26.8	.	20.7	27.1
1807	.	22.9	.	29.2	27.6	.	22.1	25.6
1808	.	25.1	.	60.5	26.5	.	26.4	33.9
1809	.	24.6	.	59.2	25.6	.	35.3	39.0
1810	.	22.2	.	24.6	24.9	.	26.8	31.8
1811	.	23.8	.	30.8	26.1	.	24.7	29.0
1812	.	26.2	.	24.1	26.2	.	21.3	30.4
1813	.	22.1	.	27.3	26.4	.	28.9	27.5
1814	.	23.8	.	32.4	29.8	.	22.2	25.1
1815	.	21.0	.	26.0	26.0	.	19.7	23.6
1816	.	20.0	.	23.4	24.5	.	19.3	22.7
1817	.	18.6	.	24.0	25.3	.	17.7	24.3
1818	.	18.5	.	24.8	25.3	.	19.1	24.4
1819	.	19.1	.	27.2	26.1	.	19.7	27.4
1820	.	20.6	.	25.3	25.4	.	18.9	24.5
1821	.	23.8	.	22.9	24.3	.	20.5	25.6
1822	.	20.1	.	27.8	25.3	.	19.5	22.6
1823	.	17.6	.	24.2	24.0	.	17.7	21.0
1824	.	18.6	.	27.3	24.5	.	18.5	20.8
1825	.	19.4	.	26.1	25.9	.	17.4	20.5
1826	.	21.4	.	25.2	26.5	.	18.5	22.6
1827	.	20.3	.	21.5	24.9	.	18.0	23.1
1828	.	23.8	.	22.6	26.2	.	19.4	26.7
1829	.	29.0	.	26.3	25.0	.	19.4	29.0
1830	25.6	25.4	.	25.4	25.0	.	19.7	24.1
1831	24.0	30.0	.	28.5	24.6	.	19.8	26.0
1832	28.0	26.0	.	33.8	28.5	.	18.5	23.4
1833	26.8	23.1	.	46.4	24.7	.	20.3	21.7
1834	27.8	23.5	.	23.9	27.8	.	22.4	25.7
1835	24.0	22.9	.	24.7	24.5	.	19.5	18.6
1836	23.9	22.2	.	31.9	22.3	.	19.2	20.0
1837	27.6	21.6	.	28.4	25.3	.	20.8	24.6
1838	25.5	19.9	22.4	22.5	24.2	.	19.9	24.1
1839	26.1	20.5	21.9	20.6	22.7	23.5	21.6	23.6
1840	25.0	21.0	22.8	22.1	23.7	22.0	19.8	20.4
1841	23.8	19.8	21.6	22.4	23.2	23.3	17.3	19.4
1842	24.9	20.1	21.7	21.9	24.0	25.8	18.0	21.1
1843	23.3	19.3	21.2	22.2	23.1	23.1	17.9	21.5
1844	22.5	19.3	21.5	21.8	22.0	24.1	17.1	20.3
1845	23.0	19.5	20.9	22.9	21.1	23.2	16.9	18.8
1846	25.1	21.5	23.0	25.1	23.2	28.5	17.9	21.8
1847	27.7	21.7	24.7	23.3	23.9	31.2	20.3	23.7
1848	24.0	21.1	23.0	23.8	23.6	29.2	20.5	19.7
1849	27.7	22.4	25.1	24.5	27.4	31.2	18.3	19.8
1850	21.2	19.1	20.8	26.3	21.4	22.5	17.2	19.8

TABLE VI ANNUAL CRUDE DEATH RATE PER

Year	EUROPE									
	Belgium	Denmark	England & Wales	Finland	France	Ireland	Italy	Netherlands	Norway	Portuga.
1851	21.4	18.5	22.0	23.7	22.3	.	.	22.6	17.1	.
1852	21.5	19.6	22.3	30.0	22.6	.	.	23.7	17.9	.
1853	22.2	25.0	22.9	29.3	22.0	.	.	24.5	18.3	.
1854	20.5	18.4	23.5	25.9	27.4	.	.	24.0	16.0	.
1855	24.7	20.0	22.6	32.0	26.0	.	.	28.1	17.2	.
1856	24.1	18.8	20.5	34.0	23.1	.	.	23.5	16.9	.
1857	22.8	21.8	21.8	32.5	23.7	.	.	26.8	17.1	.
1858	23.6	23.2	23.1	29.7	24.1	.	.	27.9	16.1	.
1859	24.2	20.3	22.4	25.0	26.8	.	.	31.2	17.0	.
1860	19.9	20.2	21.2	24.8	21.4	.	.	24.8	17.2	.
1861	22.5	18.4	21.6	23.8	23.2	.	.	25.4	19.5	.
1862	20.9	18.4	21.4	28.1	21.7	.	.	23.8	20.0	.
1863	22.3	18.3	23.0	29.6	22.5	.	30.9	23.9	18.9	.
1864	23.7	23.3	23.7	22.6	22.7	16.4	29.8	25.3	17.8	.
1865	24.7	23.2	23.2	24.9	24.3	16.5	29.9	25.9	16.6	.
1866	30.3	20.9	23.4	33.6	23.2	16.7	29.2	28.8	17.0	.
1867	21.9	20.0	21.7	38.1	22.7	16.8	34.3	23.7	18.5	.
1868	22.0	19.3	21.8	77.6	24.1	15.8	30.5	24.9	18.4	.
1869	22.1	19.1	22.3	25.2	23.5	16.4	27.9	22.9	17.1	.
1870	23.6	19.1	22.9	18.2	28.4	16.7	30.0	25.8	16.2	.
1871	28.1	19.5	22.6	17.9	35.1	16.4	30.0	29.5	16.9	.
1872	23.5	18.4	21.3	19.7	22.0	18.1	30.8	25.9	16.6	.
1873	21.8	18.6	21.0	23.6	23.3	18.3	30.1	24.2	16.9	.
1874	20.9	20.0	22.2	24.1	21.4	17.3	30.4	22.7	18.2	.
1875	22.9	21.0	22.7	22.9	23.0	18.5	30.8	25.6	18.8	.
1876	21.6	19.7	20.9	21.9	22.6	17.3	28.9	23.5	18.9	.
1877	21.4	18.7	20.3	24.2	21.6	17.5	28.4	22.2	17.0	.
1878	21.7	18.5	21.6	24.1	22.5	18.6	29.2	23.0	15.9	.
1879	22.1	19.8	20.7	19.6	22.5	19.6	29.8	22.5	15.1	.
1880	22.3	20.4	20.5	23.9	22.9	19.8	30.8	23.5	16.0	.
1881	21.1	18.3	18.9	25.0	22.0	17.5	27.6	21.5	16.9	.
1882	20.5	19.3	19.6	22.3	22.2	17.3	27.6	20.7	18.5	.
1883	21.1	18.4	19.6	20.8	22.2	19.2	27.6	21.8	17.2	.
1884	21.2	18.4	19.7	20.9	22.6	17.5	26.9	22.2	16.5	.
1885	21.4	17.9	19.2	22.0	22.0	18.4	27.0	21.0	16.6	.
1886	21.3	18.2	19.5	22.2	22.5	17.8	28.7	21.8	16.2	20.5
1887	19.3	18.3	19.1	19.0	22.0	18.2	28.0	19.7	16.1	22.3
1888	20.3	19.7	18.1	19.8	21.9	17.9	27.5	20.4	17.0	21.9
1889	19.8	18.6	18.2	19.6	20.7	17.4	25.6	20.1	17.5	22.8
1890	20.8	19.0	19.5	19.6	22.8	18.2	26.3	20.5	17.9	25.5
1891	21.2	20.0	20.2	21.2	22.9	18.4	26.1	20.7	17.5	23.0
1892	21.8	19.4	19.0	23.7	22.8	19.4	26.2	21.0	17.8	20.5
1893	20.3	18.8	19.2	20.9	22.5	17.9	25.2	19.2	16.3	21.5
1894	18.6	17.4	16.6	19.2	21.2	18.2	25.0	18.5	16.9	20.9
1895	19.5	16.8	18.7	17.7	22.2	18.4	25.1	18.6	15.7	20.9
1896	17.5	15.6	17.1	18.5	20.0	16.6	24.0	17.2	15.2	22.8
1897	17.2	16.5	17.4	17.5	19.5	18.4	21.9	16.9	15.3	21.9
1898	17.6	15.5	17.5	17.4	20.9	18.1	22.9	17.0	15.3	21.3
1899	18.8	17.3	18.2	19.9	21.1	17.6	21.9	17.1	16.9	20.2
1900	19.3	16.9	18.2	21.5	21.9	19.6	23.8	17.8	15.9	20.4

PULATION IN CERTAIN COUNTRIES, 1851 - 1900

				AMERICA				ASIA	OCEANIA		Year
Scotland	Spain	Sweden	Switzerland	Argentina	Chile	Mexico	Uruguay	Japan	Australia	New Zealand	
.	.	20.7	.	.	.	.	.	.	.	.	1851
.	.	22.7	.	.	.	.	.	.	.	.	1852
.	.	23.7	.	.	.	.	.	.	.	.	1853
.	.	19.8	.	.	.	.	.	.	.	.	1854
20.8	.	21.4	.	.	.	.	.	.	.	.	1855
19.5	.	21.8	.	.	.	.	.	.	.	.	1856
20.6	.	27.6	.	.	.	.	.	.	.	.	1857
21.0	28.0	21.7	.	.	.	.	.	.	.	.	1858
20.3	28.8	20.1	.	.	.	.	.	.	.	.	1859
22.3	27.4	17.7	.	.	.	.	.	.	20.9	.	1860
20.3	26.6	18.5	.	.	.	.	.	.	17.3	12.5	1861
21.7	27.3	21.4	.	.	.	.	.	.	17.6	11.0	1862
22.9	29.2	19.3	.	.	.	.	.	.	17.3	13.7	1863
23.6	31.5	20.2	.	.	.	.	.	.	16.3	17.4	1864
22.3	33.8	19.4	.	.	.	.	.	.	16.6	15.2	1865
22.2	29.0	20.0	.	.	.	.	.	.	18.6	12.9	1866
21.3	30.4	19.6	.	.	.	.	.	.	18.3	12.8	1867
21.2	34.1	21.0	.	.	.	.	.	.	15.5	11.9	1868
23.0	34.1	22.3	.	.	.	.	.	.	14.7	11.7	1869
22.2	31.6	19.8	25.8	.	.	.	.	.	14.2	11.1	1870
22.2	.	17.2	27.6	.	.	.	.	.	13.2	10.2	1871
22.3	.	16.3	22.2	.	.	.	.	12.2	14.5	11.7	1872
22.4	.	17.2	22.7	.	.	.	.	19.5	14.7	12.7	1873
23.2	.	20.3	22.3	.	.	.	.	20.7	16.1	13.0	1874
23.3	.	20.3	24.0	.	.	.	.	19.3	19.7	15.9	1875
20.9	.	19.6	24.1	.	.	.	.	17.9	17.6	12.7	1876
20.6	.	18.7	23.5	.	.	.	.	.	15.9	11.6	1877
21.2	30.5	18.1	23.3	.	.	.	.	.	16.3	11.1	1878
20.0	30.5	16.9	22.6	.	.	.	.	20.2	14.7	12.5	1879
20.5	30.1	18.1	21.9	.	32.1	.	.	16.8	14.6	11.5	1880
19.3	30.2	17.7	22.4	.	28.6	.	.	18.7	14.7	11.1	1881
19.4	31.4	17.4	21.9	.	29.2	.	18.1	18.1	16.0	11.2	1882
20.2	32.7	17.3	20.4	.	27.0	.	16.3	18.1	15.3	11.5	1883
19.6	30.6	17.5	20.2	.	23.8	.	17.3	18.6	16.5	10.4	1884
19.3	38.0	17.8	21.3	.	30.6	.	16.7	23.2	16.0	10.7	1885
18.9	29.2	16.6	20.7	.	32.4	.	18.3	24.4	15.4	10.5	1886
19.0	32.8	16.1	20.2	.	37.1	.	20.2	19.3	14.6	10.3	1887
18.0	30.1	16.0	19.9	.	37.3	.	18.8	19.0	14.6	9.4	1888
18.4	30.4	16.0	20.2	.	32.5	.	19.1	20.2	15.4	9.4	1889
19.7	32.1	17.1	20.7	.	36.2	.	21.2	20.4	14.3	9.7	1890
20.7	31.8	16.8	20.4	.	34.0	.	17.1	21.0	14.8	10.4	1891
18.5	30.6	17.9	18.8	.	36.5	.	17.0	21.6	12.9	10.1	1892
19.3	29.7	16.8	19.9	.	33.1	.	17.2	22.7	13.7	10.2	1893
17.1	30.3	16.4	19.9	.	32.7	.	18.5	20.1	12.7	10.2	1894
19.4	29.0	15.2	19.1	.	27.3	31.0	15.6	20.2	12.5	9.9	1895
16.6	29.6	15.6	17.7	.	29.2	31.6	15.6	21.4	12.8	9.1	1896
18.4	28.4	15.4	17.6	.	28.4	35.0	14.5	20.3	12.1	9.2	1897
18.0	28.2	15.1	18.2	.	26.4	34.3	14.4	20.4	14.1	9.8	1898
18.1	28.8	17.7	17.6	17.1	26.9	37.9	12.8	21.1	12.9	10.2	1899
18.5	28.9	16.8	19.3	18.5	33.3	33.6	13.7	20.3	11.8	9.4	1900

TABLE VII ANNUAL CRUDE DEATH RATE PER

Year	EUROPE											
	Belgium	Denmark	England & Wales	Finland	France	Ireland[1]	Italy	Netherlands	Norway	Portugal	Scotland	Sp
1901	17.2	15.8	16.9	20.6	20.1	17.8	22.0	17.2	14.9	21.1	17.9	2
1902	17.3	14.6	18.2	18.5	19.6	17.5	22.2	16.3	13.8	19.7	17.2	2
1903	17.0	14.7	15.4	17.9	19.2	17.5	22.2	16.6	14.8	20.0	16.6	2
1904	16.9	14.1	16.2	17.7	19.4	18.1	20.9	15.9	14.3	19.2	16.8	2
1905	16.5	15.0	15.2	18.4	19.6	17.1	21.7	15.3	14.8	20.2	15.9	2
1906	16.4	13.5	15.5	17.4	19.7	17.0	20.9	14.8	13.5	22.0	18.4	2
1907	15.8	14.1	15.5	17.9	20.1	17.7	20.9	14.8	14.1	19.7	16.6	2
1908	16.5	14.6	14.8	18.4	18.9	17.6	22.8	15.0	14.1	20.0	18.6	2
1909	15.8	13.3	14.8	16.6	19.1	17.2	21.7	13.7	13.4	19.2	15.8	2
1910	15.2	12.9	13.5	16.6	17.7	17.1	19.9	13.6	13.3	19.3	15.3	2
1911	16.4	13.4	14.6	16.5	19.5	16.5	21.4	14.5	13.0	22.0	15.1	2
1912	14.8	13.0	13.4	16.3	17.3	16.5	18.2	12.3	13.3	20.0	15.3	2
1913	14.6	12.5	13.8	16.1	17.6	17.1	18.7	12.4	13.1	20.4	15.6	2
1914	14.1	12.5	14.0	15.6	27.1	18.3	17.9	12.4	13.3	19.1	15.5	2
1915	13.1	12.8	15.7	15.9	28.2	17.8	22.3	12.5	13.2	20.1	17.1	2
1916	13.1	13.4	14.3	16.5	23.9	16.4	23.3	13.0	13.6	21.1	14.7	2
1917	18.3	13.2	14.2	17.7	21.6	16.7	25.9	13.2	13.4	21.9	14.4	2
1918	20.8	13.0	17.3	28.5	28.6	18.0	35.0	17.2	18.9	40.8	16.3	3
1919	15.0	13.0	14.0	18.9	19.0	17.8	18.8	13.3	13.8	25.4	15.6	2
1920	13.8	12.9	12.4	15.9	17.2	14.8	18.7	12.0	12.8	23.7	14.0	2
1921	13.8	11.0	12.1	14.0	17.7	14.2	17.7	11.1	11.5	20.9	13.8	2
1922	14.1	11.9	12.7	14.4	17.5	14.7	18.1	11.4	12.1	20.7	14.9	2
1923	13.3	11.3	11.8	13.8	16.7	14.0	17.0	9.9	11.6	23.4	12.9	2
1924	13.0	11.2	12.2	15.3	16.9	15.0	17.1	9.5	11.3	20.7	14.5	1
1925	13.1	10.8	12.1	13.5	17.4	14.6	17.1	9.8	11.1	18.2	13.5	1
1926	13.3	11.0	11.6	13.4	17.4	14.1	17.2	9.8	10.8	19.7	13.1	1
1927	13.5	11.6	12.3	14.5	16.5	14.8	16.1	10.2	11.2	18.7	13.6	1
1928	13.2	11.0	11.7	13.5	18.4	14.2	16.1	9.6	10.9	18.6	13.5	1
1929	15.1	11.2	13.4	15.0	17.9	14.8	16.5	10.7	11.5	17.8	14.7	1
1930	13.4	10.8	11.4	13.2	15.6	14.3	14.1	9.1	10.6	17.2	13.3	1
1931	13.4	11.4	12.3	13.3	18.2	14.8	14.8	9.8	10.9	16.7	13.3	1
1932	13.3	11.0	12.0	12.6	16.8	14.6	14.7	9.0	10.8	17.0	13.5	1
1933	13.3	10.6	12.3	12.9	15.8	13.7	13.7	8.8	10.2	17.1	13.2	1
1934	12.3	10.4	11.8	12.3	15.1	13.2	13.3	8.4	9.9	16.6	13.0	1
1935	12.9	11.1	11.7	12.0	15.7	14.0	13.9	8.7	10.3	17.0	13.2	1
1936	12.9	11.0	12.1	13.1	15.3	14.4	13.7	8.7	10.4	16.3	13.4	1
1937	13.2	10.8	12.4	12.8	15.3	16.3	14.3	8.8	10.4	15.8	13.9	1
1938	13.2	10.3	11.6	12.8	15.8	13.8	14.1	8.5	9.9	15.4	12.6	1
1939	13.9	10.1	12.1	14.3	15.6	14.2	13.4	8.6	10.1	15.3	12.9	1
1940	16.2	10.4	14.4	19.2	19.1	14.2	13.6	9.9	10.9	15.8	14.8	1
1941	14.7	10.3	13.5	19.7	17.4	14.8	13.9	10.0	10.8	17.4	15.2	1
1942	14.8	9.6	12.3	15.1	17.0	14.1	14.3	9.5	10.7	18.1	13.3	1
1943	13.6	9.6	13.0	13.3	16.4	14.8	16.2	10.0	10.4	15.3	13.4	1
1944	16.0	10.3	12.7	18.1	19.4	15.3	15.9	11.8	10.7	14.8	12.8	1
1945	14.9	10.5	12.7	13.0	16.4	14.5	13.9	15.3	9.7	14.2	12.3	1
1946	13.8	10.2	12.0	11.7	13.4	14.0	12.1	8.5	9.4	14.7	12.5	1
1947	13.3	9.7	12.3	11.9	13.2	14.8	11.5	8.1	9.5	13.6	13.2	1
1948	12.6	8.6	10.8	11.2	12.5	12.2	10.7	7.4	8.9	13.0	11.8	1
1949	12.9	8.9	11.7	11.2	13.9	12.8	10.5	8.1	9.0	14.1	12.3	1
1950	12.5	9.2	11.8	10.1	12.8	12.7	9.8	7.6	9.1	12.2	12.5	1
1951	12.6	8.8	12.5	10.0	13.5	14.3	10.3	7.5	8.4	12.4	12.9	1
1952	11.9	9.0	11.3	9.5	12.4	11.9	10.1	7.3	8.5	11.8	12.0	
1953	12.1	9.0	11.4	9.6	13.1	11.7	10.0	7.7	8.5	11.3	11.5	
1954	11.9	9.1	11.3	9.1	12.1	12.1	9.2	7.5	8.6	10.9	12.0	
1955	12.3	8.7	11.7	9.3	12.2	12.8	9.3	7.8	8.5	11.3	12.0	
1956	12.2	8.8	11.7	9.0	12.5	11.7	10.3	7.8	8.5	12.1	12.0	

[1] Excluding Northern Ireland from 1922 onwards.
[2] For the death-registration States.
[3] Registration area. Excluding Burma from 1921.

PULATION IN CERTAIN COUNTRIES, 1901 - 1956

		AMERICA					ASIA		OCEANIA		Year
Sweden	Switzerland	Argentina	Chile	Mexico	Uruguay	USA[2]	India[3]	Japan	Australia	New Zealand	
16.1	18.0	18 5	34.3	32.2	13.0	16.4	29 4	20.4	11.6	9.8	1901
15.4	17.2	19.3	27 1	34·5	13.6	15.5	31.7	20.8	11 9	10.5	1902
15 1	17.6	16.4	26.9	32·6	13.4	15.6	34.9	20.0	11.6	10.4	1903
15.3	17.8	15.0	28.8	31·4	11·8	16.4	33.0	20 3	10.6	9.6	1904
15·6	17.9	15.4	32·3	32·0	13.7	15.9	36.1	21·1	10.1	9.3	1905
14.4	16.6	17·3	33.0	33.1	15.0	15.7	34.7	19.7	10.9	9.3	1906
14.6	16.4	.	29.7	33.0	15.2	15.9	37.2	20.7	11.0	11.0	1907
14.9	15.8	.	31.9	31.8	13.9	14.7	38.2	20.9	11.1	9.6	1908
13.7	16.1	.	31.7	32.3	14.3	14.2	30.9	21.9	10.3	9.2	1909
14.0	15.1	18.9	31.7	33.3	14.9	14.7	31.6	21.1	10.4	9.7	1910
13.8	15.8	18.2	31.9	.	14.4	13.9	33.2	20.3	10.7	9.4	1911
14.2	14.2	17.0	30.4	.	14.1	13.6	29.7	19.9	11.2	8.9	1912
13.7	14.3	16.3	31.0	.	12.6	13.8	28.7	19.4	10.7	9.5	1913
13.8	13.8	15.4	28.6	.	12.2	13.3	30.0	20.5	10.5	9.3	1914
14.7	13.3	15.8	27.3	.	12.9	13.2	29.9	20.1	10.6	9.1	1915
13.6	13.0	17.1	27.9	.	15.3	13.8	29.1	21.5	11.0	9.6	1916
13.4	13.7	16.1	29.6	.	12.8	14.0	32.7	22.7	9.7	9.6	1917
18.0	19.3	18.2	29.7	.	14.3	18.1	62.5	26.8	10.0	14.8	1918
14.5	14.2	18.4	37.2	.	13.2	12.9	35.9	22.8	12.7	9.5	1919
13.3	14.4	15.5	31.0	.	12.9	13.0	30.8	25.4	10.5	10.2	1920
12.4	12.8	15.8	32.9	.	12.2	11.5	30.9	22.7	9.9	8.7	1921
12.8	13.0	14.0	28.6	25.3	10.6	11.7	23.8	22.3	9.2	8.8	1922
11.4	11.8	14.8	33.0	24.4	11.4	12.1	24.6	22.8	9.9	9.0	1923
12.0	12.6	14.3	29.5	25.6	11.8	11.6	27.8	21.2	9.5	8.3	1924
11.7	12.2	14.1	27.7	26.5	11.7	11.7	23.9	20.3	9.2	8.3	1925
11.8	11.8	13.6	27.2	24.9	10.5	12.1	25.6	19.2	9.4	8.7	1926
12.7	12.4	14.1	26.2	24.0	11.5	11.3	23.6	19.8	9.4	8.5	1927
12.0	12.0	13.2	24.7	25.3	10.7	12.0	24.0	19.9	9.4	8.5	1928
12.2	12.5	13.8	26.2	26.8	10.7	11.9	24.1	20.1	9.5	8.8	1929
11.7	11.6	12.7	24.7	26.6	10.7	11.3	24.8	18.2	8.6	8.6	1930
12.5	12.1	12.4	22.0	25.9	11.0	11.1	25.1	19.0	8.7	8.4	1931
11.6	12.1	11.9	22.8	26.1	10.1	10.9	21.6	17.7	8.6	8.0	1932
11.2	11.4	11.8	26.8	25.7	10.3	10.7	22.3	17.8	8.9	8.0	1933
11.2	11.3	11.7	26.8	23.6	10.0	11.1	24.8	18.1	9.3	8.5	1934
11.7	12.1	13.1	25.0	22.6	10.6	10.9	23.4	16.8	9.5	8.3	1935
12.0	11.4	11.9	25.3	23.5	9.7	11.6	22.3	17.5	9.4	8.8	1936
12.0	11.3	.	23.1	24.4	10.4	11.3	22.0	17.0	9.4	9.1	1937
11.5	11.6	11.4	23.5	22.9	10.3	10.6	23.7	17.7	9.6	9.7	1938
11.5	11.8	10.4	23.3	23.0	9.1	10.6	21.6	17.8	9.9	9.2	1939
11.4	12.0	10.4	21.6	23.2	9.6	10.7	21.1	16.4	9.8	9.2	1940
11.3	11.1	10.1	19.8	22.1	9.4	10.5	21.9	15.7	10.6	9.9	1941
9.9	10.9	10.0	20.3	22.8	9.4	10.4	21.4	15.8	12.0	10.6	1942
10.2	11.0	9.9	19.9	22.4	9.3	10.9	23.9	16.3	11.5	10.1	1943
11.0	12.0	10.2	19.5	20.6	8.9	10.6	24.5	17.4	10.3	9.9	1944
10.8	11.6	10.3	20.0	19.6	.	10.6	22.1	29.2	10.3	10.1	1945
10.6	11.3	9.6	17.2	19.4	.	10.0	18.7	17.6	10.1	9.7	1946
10.8	11.4	9.9	16.1	16.4	.	10.1	19.5	14.6	9.7	9.4	1947
9.8	10.8	9.4	16.7	16.7	8.3	9.9	17.0	12.0	10.0	9.2	1948
10.0	10.7	9.0	17.3	17.6	7.8	9.7	15.8	11.6	9.6	9.1	1949
10.0	10.1	9.0	15.0	16.2	8.0	9.6	16.1	10.9	9.6	9.3	1950
9.9	10.5	8.9	15.0	17.3	7.8	9.7	14.4	10.0	9.7	9.6	1951
9.6	9.9	8.5	13.0	15.0	7.7	9.6	13.8	8.9	9.4	9.3	1952
9.7	10.2	8.8	12.4	15.9	7.7	9.6	14.5	8.9	9.1	8.8	1953
9.6	10.0	8.3	12.8	13.1	7.4	9.2	12.5	8.2	9.1	9.0	1954
9.5	10.1	8.7	12.8	13.7	7.9	9.3	11.7	7.8	8.9	9.0	1955
9.6	10.2	8.2	12.1	12.1	6.9	9.4	.	8.0	9.1	9.0	1956

TABLE VIII INFANT MORTALITY RATE PER 1000 LIVE BIRTHS IN CERTAIN COUNTRIES. FIVE YEAR AVERAGES, 1801 - 1900

PERIOD	EUROPE													OCEANIA	
	Belgium	Denmark	England & Wales	Finland	France	Ireland	Italy	Netherlands	Norway	Scotland	Spain	Sweden	Switzerland	Australia	New Zealand
1801-1805	.	.	.	.	.	.	.	.	.	.	.	186	.	.	.
1806-1810	.	.	.	.	187	.	.	.	.	.	.	211	.	.	.
1811-1815	.	.	.	.	185	.	.	.	.	.	.	192	.	.	.
1816-1820	.	.	.	.	171	.	.	.	.	.	.	176	.	.	.
1821-1825	.	.	.	.	144	.	.	.	.	.	.	159	.	.	.
1826-1830	.	.	.	.	163	.	.	.	.	.	.	176	.	.	.
1831-1835	.	.	.	.	183	.	.	.	.	.	.	167	.	.	.
1836-1840	.	144	.	.	166	.	.	.	140	.	.	166	.	.	.
1841-1845	149	136	148	.	155	.	.	.	118	.	.	154	.	.	.
1846-1850	152	148	157	.	162	.	.	190	112	.	.	153	.	.	.
1851-1855	152	134	156	.	166	.	.	190	105	.	.	149	.	.	.
1856-1860	158	136	152	.	179	.	.	205	101	119	180	143	.	.	.
1861-1865	165	137	151	.	179	.	.	197	106	120	187	136	.	.	.
1866-1870	142	132	157	212	177	95	.	201	113	122	196	142	.	.	.
1871-1875	151	137	153	170	178	95	217	210	108	127	.	134	198	119	.
1876-1880	155	139	145	163	166	99	209	197	101	118	192	126	188	121	96
1881-1885	156	134	139	161	167	94	195	181	99	118	193	116	171	125	90
1886-1890	163	136	145	144	166	95	195	175	96	121	186	105	159	119	84
1891-1895	164	139	151	145	170	102	184	165	98	126	.	103	155	109	88
1896-1900	158	132	156	139	158	106	168	151	96	129	.	100	143	112	80

TABLE IX INFANT MORTALITY RATE PE

Year	EUROPE										
	Belgium	Denmark	England & Wales	Finland	France	Ireland	Italy	Netherlands	Norway	Portugal	Scot.
1901	148.7	134.3	151.3	144.5	143.7	95.6	166.3	149.3	91.1	.	12
1902	150.5	113.9	132.9	129.0	137.8	95.5	171.8	129.9	73.8	146.4	11
1903	161.1	115.9	131.5	127.3	140.1	92.2	171.9	135.1	77.9	147.1	11
1904	158.2	111.5	145.3	119.8	147.3	95.8	161.1	136.9	74.8	139.1	12
1905	152.4	121.0	128.2	134.6	139.1	90.3	166.2	130.9	81.5	141.8	11
1906	159.8	108.9	132.5	119.4	145.7	88.1	160.9	127.1	69.1	163.3	11
1907	139.3	108.4	117.6	112.0	133.2	88.5	155.9	111.9	65.8	147.2	10
1908	154.2	123.2	120.4	125.1	130.0	91.3	147.9	124.8	75.0	156.7	12
1909	144.5	97.7	108.7	111.0	120.3	87.4	157.0	99.1	69.5	144.7	10
1910	141.1	102.2	105.4	117.7	112.4	89.2	140.0	107.9	67.2	133.9	10
1911	173.0	105.8	130.1	113.8	159.2	91.4	156.7	137.2	64.5	.	11
1912	126.7	93.2	94.8	108.6	105.9	82.2	128.0	87.0	67.2	.	10
1913	136.4	93.5	108.4	112.8	114.1	93.1	138.2	91.4	64.3	159.6	10
1914	.	98.3	104.6	104.2	112.4	81.1	130.3	94.8	67.6	148.2	11
1915	131.6	95.0	109.7	110.5	144.0	85.3	146.8	86.8	67.3	148.2	12
1916	122.9	99.9	91.2	110.1	125.7	81.3	166.3	84.5	64.0	153.6	9
1917	146.6	99.6	96.5	118.2	126.8	84.1	158.2	87.1	64.0	148.4	10
1918	139.9	74.2	97.2	115.2	140.4	80.2	191.8	102.8	62.9	209.1	9
1919	109.4	91.6	89.1	134.6	122.5	84.4	129.1	93.1	61.7	181.7	10
1920	110.2	90.2	79.9	96.7	99.2	77.5	126.7	82.5	57.5	164.1	9
1921	122.1	77.0	82.8	94.6	116.9	72.6	129.3	85.3	53.8	147.7	9
1922	113.6	85.4	77.1	99.2	86.6	68.9	126.3	76.8	54.5	144.0	10
1923	99.7	82.9	69.4	92.4	96.3	66.4	127.5	66.2	49.5	164.1	7
1924	94.5	84.5	75.1	106.9	84.8	71.7	126.3	60.6	50.0	143.8	9
1925	99.7	79.8	75.0	85.0	94.2	67.9	119.3	58.4	50.2	132.1	9
1926	103.8	84.4	70.2	85.6	101.9	74.4	126.5	61.1	47.9	144.2	8
1927	98.4	83.4	69.7	97.1	88.6	70.8	120.2	58.7	50.7	141.5	8
1928	94.1	80.8	65.1	84.0	96.6	67.9	120.3	52.3	49.0	.	8
1929	110.5	82.9	74.4	97.6	101.0	70.4	124.8	59.0	54.4	151.2	8
1930	99.5	79.6	60.0	75.1	78.2	67.9	105.5	50.9	45.6	143.6	8
1931	89.3	81.4	66.4	74.8	75.8	68.9	112.9	49.6	46.3	140.6	8
1932	93.6	72.3	65.0	70.9	77.0	72.2	110.5	46.3	46.8	146.5	8
1933	92.0	67.6	63.7	75.7	74.8	65.2	100.1	43.9	47.6	148.5	8
1934	82.5	64.4	58.6	73.0	69.4	63.3	98.7	42.6	39.3	144.0	7
1935	84.6	71.0	56.9	66.8	68.9	68.4	101.2	40.0	44.2	148.7	7
1936	86.1	67.3	58.5	65.9	67.0	74.1	100.4	38.9	42.0	139.7	8
1937	82.8	66.1	57.6	68.5	65.4	73.0	108.8	38.1	42.0	151.4	8
1938	81.3	58.7	52.7	67.8	65.6	66.6	106.3	36.5	37.3	137.2	6
1939	82.4	58.1	50.8	69.6	63.5	65.8	97.0	33.7	37.2	119.9	6
1940	93.2	50.2	57.4	88.3	90.5	66.4	102.7	39.1	38.7	126.1	7
1941	91.6	55.0	59.7	59.2	72.7	73.5	115.2	43.6	43.0	150.8	8
1942	83.9	47.0	49.5	67.2	71.0	69.4	112.4	39.5	35.9	131.4	6
1943	74.5	44.8	48.9	49.5	75.3	82.6	112.8	40.1	35.4	132.6	6
1944	82.6	47.7	44.5	68.6	77.7	79.4	101.6	46.3	36.7	122.2	6
1945	99.6	48.3	47.0	63.2	108.8	70.9	98.1	79.7	36.4	114.9	5
1946	74.8	45.8	40.9	56.2	67.5	64.6	87.4	38.7	34.6	119.4	5
1947	68.7	40.4	41.8	58.5	66.5	67.9	85.5	33.5	34.6	107.3	5
1948	59.1	35.3	34.5	51.9	55.9	50.3	72.1	29.3	29.6	100.2	4
1949	57.2	34.5	32.7	48.3	60.2	53.2	73.9	26.8	27.7	114.5	4
1950	53.4	30.7	29.9	43.5	52.0	46.2	63.8	25.2	28.2	94.1	3
1951	50.0	28.9	29.8	35.4	50.8	45.7	66.5	25.1	25.7	89.1	3
1952	44.8	28.9	27.5	31.8	45.2	41.4	63.4	22.5	23.7	94.3	3
1953	41.9	27.2	26.8	34.2	41.9	39.4	58.4	22.1	22.0	95.5	3
1954	41.4	26.9	25.4	30.6	40.7	37.8	53.0	21.1	21.4	85.5	3
1955	40.7	25.2	24.9	29.7	38.6	36.7	50.9	20.1	20.6	90.2	3
1956	39.4	24.9	23.6	25.4	36.2	35.6	48.8	19.0	21.2	87.8	2

[1]From 1946, rates computed on number of live births adjusted for under-registration.

E BIRTHS IN CERTAIN COUNTRIES, 1901 - 1956

			AMERICA				ASIA			OCEANIA		Year
pain	Sweden	Switzerland	Chile[1]	Mexico	Uruguay	USA	Ceylon	India	Japan	Australia	New Zealand	
36.9	102.9	137.2	339.8	266.4	102.0		170	.	149.9	103.6	71.4	1901
30.5	86.4	131.7	270.3	331.9	106.5	.	173		154.0	107.2	82.9	1902
62.0	92.8	133.3	263.6	310.1	109.1	.	164		152.4	111.4	81.1	1903
72.9	84.4	140.1	285.6	266.8	88.9	.	174	.	151.9	81.8	71.0	1904
61.3	88.3	128.8	249.5	286.9	82.3	.	176	.	151.7	81.8	67.5	1905
73.7	81.0	126.7	327.2	318.5	109.2	.	198		153.6	83.3	62.1	1906
68.0	76.8	121.0	297.6	310.6	108.8	.	186		151.3	81.1	88.8	1907
69.9	85.4	107.6	317.7	288.1	100.6	.	183	.	158.0	77.8	67.9	1908
63.7	72.2	114.9	315.2	294.3	100.5	.	202	.	167.3	71.6	61.6	1909
49.3	75.1	105.0	267.3	323.1	110.7	.	176	.	161.2	74.8	67.7	1910
62.1	72.0	123.4	332.8	.	109.4	.	218	204.7	158.4	68.5	56.3	1911
37.5	70.9	93.8	236.9	.	117.6	.	215	207.2	154.2	71.7	51.2	1912
55.2	69.7	96.0	285.6	.	93.3	.	189	204.8	152.1	72.2	59.2	1913
51.8	72.9	91.5	254.7	.	94.5	.	213	211.7	158.5	71.6	51.4	1914
51.9	75.8	90.0	254.3	.	111.3	99.9	171	201.2	160.4	67.5	50.1	1915
46.9	69.7	78.5	241.3	.	123.9	101.0	184	202.4	170.3	70.3	50.7	1916
55.2	64.5	79.2	269.3	.	106.9	93.8	174	205.4	173.2	55.9	48.2	1917
83.0	64.6	88.2	254.7	.	110.1	100.9	187.9	267.0	188.6	58.6	48.4	1918
62.8	69.6	82.4	306.4	.	100.5	86.6	222.7	224.8	170.5	69.2	45.3	1919
70.8	63.3	83.7	263.4	.	117.3	85.8	182.0	195.4	166.2	69.1	50.6	1920
54.2	64.0	74.0	278.4	.	107.1	75.6	192.1	199.0	169.2	65.7	47.8	1921
48.4	62.6	69.6	240.2	223.1	93.5	76.2	187.9	174.6	167.2	52.7	41.9	1922
54.1	66.2	60.6	283.0	222.4	103.5	77.1	212.0	175.2	164.2	60.5	43.8	1923
46.9	60.3	62.0	266.3	232.2	107.6	70.8	186.5	188.3	156.9	67.1	40.2	1924
43.1	65.7	68.4	257.8	215.9	115.2	71.7	171.9	173.9	142.8	53.4	40.0	1925
34.3	56.0	56.5	250.9	209.4	93.4	73.3	174.1	188.6	138.0	54.0	39.8	1926
33.2	59.8	66.8	226.1	193.0	106.1	64.6	160.4	165.9	142.3	54.5	38.7	1927
32.7	58.8	63.6	211.6	193.4	99.5	68.7	177.2	171.7	138.2	63.0	36.2	1928
29.7	68.6	62.1	224.3	167.6	92.7	67.6	186.7	176.8	142.6	51.1	34.1	1929
23.8	54.7	60.8	234.4	131.6	99.7	64.6	174.9	180.0	124.5	47.2	34.5	1930
22.6	66.6	49.4	231.9	137.7	109.6	61.6	157.9	178.4	132.0	42.1	32.2	1931
17.6	50.7	51.0	235.0	137.6	98 6	57.6	162.3	168.1	117.9	41.3	31.2	1932
18.1	49.5	47.8	257.9	139.3	92.8	58.1	157.2	169.7	121.7	39.5	31.6	1933
18.6	47.2	45.7	261.9	130.3	95.7	60.1	173.0	185.4	125.3	43.6	32.1	1934
15.3	45.9	47.9	250.9	125 7	102.0	55 7	263.2	162.8	107.1	39.8	32.3	1935
14.0	43.4	46.5	252.2	130.8	91.6	57 1	166.5	161.0	117.2	41.2	31.0	1936
34.8	45.2	46.7	240.7	130.8	96.2	54.4	158.2	161.7	106.2	38.1	31.2	1937
24.2	42.6	42.8	235.7	128.0	98.8	51.0	161.4	167.1	115.0	38.3	35.6	1938
40.3	39.6	42.6	224.6	122.6	82.1	48.0	165.8	155.6	106.7	38.2	31.1	1939
13.7	39.2	46.2	217.2	125.7	86 5	47 0	148.9	159.8	90.4	38.4	30.2	1940
48.6	37.0	41.1	200.2	123.0	82.8	45 3	129.4	158.0	84 4	39.7	29.8	1941
08.5	29.3	38.3	194.7	118.2	92.7	40.4	120.5	162.6	85.8	39.5	28.7	1942
04.4	28.9	39.8	194.0	117.2	77.9	40.4	132.0	164.6	87 0	36.3	31.4	1943
98.1	31.1	42.2	180.8	113.6	65.7	39.8	136.1	169.3	.	31.3	30.1	1944
90.1	29.9	40.7	184.1	107.9	.	38.3	139.7	150.9	.	29.4	28.0	1945
92.4	26.6	39.2	137.2	110.6	.	33.8	140.6	136.4	.	29.0	26.1	1946
76.1	26.4	39.3	145.1	96.0	.	32.2	101.0	145.6	76.7	28.5	25.0	1947
70.0	23.2	36.9	147.0	101.7	60.6	32.0	92.1	130.1	61.7	27.8	21.9	1948
74.6	23.3	34.3	165.2	106.4	62.4	31.3	87.0	122.8	62.5	26.3	23.8	1949
69.8	21.0	31.2	139.4	96.2	64.2	29.2	81.6	127.1	60.1	24.6	22.7	1950
68.2	21.6	30.1	136.6	98.8	64.7	28.4	81.9	124.3	57.6	26.2	22.8	1951
60.8	20.0	29.1	129.2	89.8	61.0	28.4	78.4	116.9	49.4	23.8	21.8	1952
58.9	18.7	29.8	112.4	96.2	61.2	27.8	71.2	117.8	48.9	23.3	20.1	1953
64.2	18.7	27.2	126.1	80.6	49.3	26.6	72.0	109.4	44.6	22.5	20.0	1954
56.3	17.4	26.6	120.8	83.3	82.2	26.4	71.5	99.9	39.8	22.0	20.1	1955
62.3	17.3	25.8	112.3	71.0	73.0	26.0	66.6	.	40.6	21.7	19.4	1956

TABLE X EXPECTATION OF LIFE AT BIRTH BY SEX IN CE

AUSTRALIA			CEYLON			DENMARK			ENGLAND & WALES		
Period	Male	Female	Period	Male	Female	Period	Male	Female	Period	Male	Fem
.	.	.	.	.	.	.	.	.	.	.	
.	.	.	.	.	.	1835-1844	42.60	44.70	1838-1854	39.91	41
.	.	.	.	.	.	.	.	.	.	.	
.	.	.	.	.	.	.	.	.	.	.	
.	.	.	.	.	.	.	.	.	.	.	
.	.	.	.	.	.	1860-1869	43.60	45.50	.	.	
.	.	.	.	.	.	.	.	.	1871-1880	41.35	44
1881-1890	47.20	50.84	.	.	.	1880-1889	46.80	48.90	1881-1890	43.66	47
.	.	.	.	.	.	1885-1894	46.90	49.20	.	.	
1891-1900	51.08	54.76	.	.	.	1895-1900	50.20	53.20	1891-1900	44.13	47
1901-1910	55.20	58.84	.	.	.	1901-1905	52.90	56.20	1901-1910	48.53	52
.	.	.	.	.	.	1906-1910	54.90	57.90	.	.	
.	.	.	.	.	.	1911-1915	56.20	59.20	1910-1912	51.50	55
.	.	.	.	.	.	1916-1920	55.80	58.10	.	.	
1920-1922	59.15	63.31	1920-1922	32.72	30.67	1921-1925	60.30	61.90	1920-1922	55.62	59
.	.	.	.	.	.	1926-1930	60.90	62.60	.	.	
1932-1934	63.48	67.14	.	.	.	1931-1935	62.00	63.80	1930-1932	58.74	62
.	.	.	.	.	.	1936-1940	63.50	65.80	1937	60.18	64
.	.	.	1945-1947	46.79	44.72	1941-1945	65.62	67.70	.	.	
1946-1948	66.07	70.63	1949	56.07	54.79	1946-1950	67.75	70.14	1948	66.39	71
.	.	.	1950	56.36	54.83	.	.	.	1950-1952	66.42	71
.	.	.	1954	60.30	59.40	.	.	.	1953-1955	67.52	72

JAPAN			NETHERLANDS			NEW ZEALAND			N
Period	Male	Female	Period	Male.	Female	Period	Male	Female	Period
.	.	.	.	.	.	.	.	.	1821-1830
.	.	.	1840-1851	29.53	32.57	.	.	.	1831-1840
.	.	.	.	.	.	.	.	.	1841-1850
			1850-1859	36.44	38.21	.	.	.	1846-1855
.	.	.	.	.	.	.	.	.	1856-1865
.	.	.	.	.	.	.	.	.	.
.	.	.	1870-1879	38.40	40.70	.	.	.	1871-1880
.	.	.	1880-1889	42.50	45.00	.	.	.	1881-1890
.	.	.	.	.	.	1891-1895	55.29	58.09	.
1889-1898	42.80	44.30	1890-1899	46.20	49.00	1896-1900	57.37	59.95	1891-1900
1899-1903	43.97	44.85	1900-1909	51.00	53.40	1901-1905	58.09	60.55	1901-1910
1909-1913	44.25	44.73	.	.	.	1906-1910	59.17	61.76	.
.	.	.	1910-1920	55.10	57.10	1911-1915	60.96	63.48	1911-1920
.	.	.	.	.	.	.	.	.	.
1921-1925	42.06	43.20	1921-1930	61.90	63.50	1921-1922	62.76	65.43	1921-1930
1926-1930	44.82	46.54	.	.	.	1925-1927	63.99	66.57	.
.	.	.	1931-1935	65.10	66.40	1931	65.04	67.88	1931-1940
1935-1936	46.92	49.60	1931-1940	65.50	67.20	1934-1938	65.46	68.45	.
.	.	.	.	.	.	.	.	.	1945-1948
1947	50.06	53.96	1947-1949	69.40	71.50	.	.	.	1946-1950
1950-1952	59.57	62.97	1950-1952	70.60	72.90	1950-1952	68.29	72.43	.
1955	63.88	68.41	1953-1955	71.00	73.90	.	.	.	.

1 From 1949, Federal Republic of Germany only

UNTRIES FROM THE EARLIEST PERIOD AVAILABLE

FRANCE			GERMANY[1]			INDIA			ITALY		
iod	Male	Female	Period	Male	Female	Period	Male	Female	Period	Male	Female
-1831	38.30	40.80	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.
-1865	39.10	40.55	.	.	.	.	.	.	.	.	.
-1881	40.83	43.42	1871-1880	35.58	38.45	.	.	.	1876-1887	35.10	35.40
.	.	.	1881-1890	37.17	40.25	1881	23.67	25.58	1881-1882	35.16	35.65
.	.	.	.	.	.	1881-1890	24.59	25.54	.	.	.
-1903	45.74	49.13	1891-1900	40.56	43.97	1891-1900	23.63	23.96	1899-1902	42.59	43.00
.	.	.	1901-1910	44.82	48.33	1901-1910	22.59	23.31	1901-1910	44.24	44.83
-1913	48.50	52.42	.	.	.	.	.	.	.	.	.
.	.	.	1910-1911	47.41	50.68	.	.	.	1910-1912	46.57	47.33
.	.	.	.	.	.	.	.	.	.	.	.
-1923	52.19	56.09	1924-1926	55.97	58.82	1921-1930	26.91	26.56	1921-1922	49.25	50.75
-1933	54.30	59.02	.	.	.	.	.	.	.	.	.
.	.	.	1932-1934	59.86	62.75	.	.	.	1930-1932	53.76	56.00
-1938	55.94	61.64	.	.	.	.	.	.	1935-1937	.	57.49
.	.	.	.	.	.	.	.	.	.	.	.
-1948	62.50	68.00	1949-1951	64.56	68.48	1941-1950	32.45	31.66	.	.	.
-1951	63.60	69.30	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.

	SWEDEN			SWITZERLAND			USA (White)		
ale	Period.	Male	Female	Period	Male	Female	Period	Male	Female
00	1816-1840	39.50	43.56	.	.	.	.	.	.
60	1841-1845	41.94	46.60	.	.	.	.	.	.
90	1846-1850	41.38	45.59	.	.	.	.	.	.
90	1851-1855	40.51	44.64	.	.	.	.	.	.
95	1856-1860	40.48	44.15	.	.	.	.	.	.
	1861-1870	42.80	46.40	.	.	.	.	.	.
30	1871-1880	45.30	48.60	1876-1880	40.60	43.20	.	.	.
21	1881-1890	48.55	51.47	1881-1888	43.29	45.70	.	.	.
.	.	.	.	.	.	.	.	.	.
14	1891-1900	50.94	53.63	1889-1900	45.70	48.50	.	.	.
70	1901-1910	54.53	56.98	1901-1910	49.25	52.15	1900-1902	48.23	51.08
.	.	.	.	.	.	.	1909-1911	50.23	53.62
71	1911-1920	55.60	58.38	1910-1911	50.64	53.89	.	.	.
.	.	.	.	.	.	.	1919-1921	56.34	58.53
84	1921-1925	60.72	62.95	1920-1921	54.48	57.50	.	.	.
	1926-1930	61.19	63.33	1921-1930	58.15	61.41	1929-1931	59.12	62.67
60	1931-1935	63.22	65.33	1929-1932	59.25	63.05	1930-1939	60.60	64.60
	1936-1940	64.30	66.92	1933-1937	60.70	64.60	1939-1941	62.81	67.29
70	1941-1945	67.06	69.71	1939-1944	62.68	66.96	1945	64.40	69.50
65	1946-1950	69.04	71.58	.	.	.	1948	65.50	71.00
	1951-1955	70.49	73.43	1948-1953	66.36	70.85	1952	66.60	72.70
	.	.	.	.	.	.	1955	67.30	73.60

TABLE XI TYPHOID AND PARATYPHOID FEVERS. ANNUAL

Year	Belgium	Denmark	England & Wales	Finland	France	Germany[1]	Ireland
1901	22.4	.	15.5	.	.	10.6	10.9
1902	18.0	.	12.6	.	.	7.0	10.6
1903	15.7	.	10.1	.	.	7.4	9.1
1904	15.0	.	9.3	.	.	7.0	8.7
1905	13.9	.	9.0	.	.	6.3	8.7
1906	12.5	.	9.2	.	13.9	5.7	6.8
1907	12.1	.	6.8	.	13.1	4.9	7.0
1908	11.3	.	7.5	.	12.3	4.7	7.0
1909	9.4	.	6.0	.	9.8	4.2	7.9
1910	10.4	.	5.3	.	8.0	4.0	6.2
1911	10.5	.	6.7	.	13.3	4.9	8.5
1912	8.6	.	4.4	.	9.4	3.2	5.9
1913	9.4	.	4.1	.	9.0	2.9	6.6
1914	.	.	4.6	.	24.5	8.6	6.7
1915	.	.	3.5	.	18.6	10.5	5.9
1916	.	.	3.0	.	8.6	4.3	6.8
1917	.	.	2.8	.	7.6	7.8	6.2
1918	.	.	2.6	.	8.2	7.8	6.2
1919	9.9	.	1.6	.	5.6	6.4	4.3
1920	6.4	1.4	1.4	.	6.3	4.5	5.8
1921	6.3	1.2	1.6	.	6.6	4.1	4.5
1922	5.1	1.0	1.2	.	.	2.8	3.2
1923	4.5	1.3	1.2	.	.	3.1	4.7
1924	3.6	1.0	1.3	.	.	3.0	4.1
1925	3.5	1.4	1.0	.	4.5	2.7	3.5
1926	3.8	1.1	0.9	.	5.4	2.4	4.2
1927	2.8	0.9	0.9	2.8	4.8	1.7	3.3
1928	2.8	0.6	1.1	2.2	5.4	1.7	3.2
1929	2.6	1.0	1.0	1.6	4.8	1.6	3.0
1930	3.5	0.8	0.8	2.2	3.9	1.2	2.4
1931	2.3	1.0	0.7	2.2	4.0	1.0	2.3
1932	2.2	1.8	0.6	2.7	3.8	1.2	2.8
1933	1.7	0.6	0.5	2.8	3.3	0.9	2.5
1934	1.8	0.7	0.4	2.6	3.1	1.0	3.0
1935	1.6	0.7	0.5	1.5	2.6	0.9	2.2
1936	1.2	0.3	0.6	2.2	2.5	0.8	2.1
1937	1.4	0.4	0.5	3.4	.	0.8	2.2
1938	1.4	0.3	0.3	1.8	.	0.7	1.6
1939	1.1	0.1	0.3	1.2	.	1.0	1.9
1940	1.2	0.2	0.3	4.1	2.6	.	1.0
1941	1.1	0.4	0.4	5.7	3.1	.	1.3
1942	1.2	0.3	0.2	8.3	4.0	.	2.0
1943	1.4	0.0	0.2	2.7	4.2	.	1.8
1944	1.3	0.2	0.1	5.3	4.1	.	2.0
1945	2.0	0.9	0.1	7.1	3.6	.	1.1
1946	1.3	0.1	0.1	5.2	2.1	.	0.9
1947	0.8	0.4	0.1	4.2	2.2	4.4	0.5
1948	0.8	0.2	0.1	1.8	1.8	2.5	0.5
1949	0.7	0.1	0.1	1.8	2.0	1.6	0.4
1950	0.8	0.1	0.0	0.7	0.8	1.1	0.3
1951	0.3	0.1	0.1	0.2	0.5	0.6	0.2
1952	0.2	0.2	0.1	0.5	0.4	0.4	0.1
1953	0.1	0.2	0.1	0.2	0.3	0.4	0.1
1954	0.2	0.1	0.1	0.1	0.3	0.2	0.1
1955	0.1	-	0.0	0.3	0.3	0.3	0.2

[1] From 1947, Federal Republic of Germany only

. = Not available
- = No deaths reco
0.0 = Rate less than

TE PER 100,000 POPULATION IN CERTAIN COUNTRIES, 1901-1955

Netherlands	Norway	Portugal	Scotland	Spain	Sweden	Switzerland	Year
9.1	7.7	.	16.0	51.3	12.5	7.2	1901
8.6	4.5	17.4	12.2	45.7	10.4	6.1	1902
8.5	6.1	18.9	12.2	43.1	4.7	4.9	1903
8.9	4.3	18.4	9.0	44.0	4.7	7.6	1904
8.3	3.7	14.3	8.1	37.3	6.5	4.9	1905
8.0	5.4	17.4	8.7	41.7	4.1	4.7	1906
6.5	3.3	13.6	7.9	35.0	4.1	4.9	1907
6.3	3.4	17.0	6.0	34.7	5.1	3.7	1908
5.4	2.9	12.9	6.3	27.3	2.9	3.1	1909
5.1	3.8	13.5	5.6	23.1	4.3	4.1	1910
5.3	2.3	.	5.7	26.5	4.2	4.8	1911
3.5	2.3	.	4.1	22.3	3.1	3.5	1912
3.8	3.9	15.0	3.6	22.9	4.1	2.6	1913
3.9	3.0	12.2	4.7	31.3	4.7	2.5	1914
3.5	2.3	13.3	3.6	25.1	3.1	2.8	1915
3.3	2.5	14.8	3.1	24.5	3.5	2.3	1916
4.7	4.2	16.4	2.0	26.4	3.4	2.9	1917
8.8	4.5	15.1	2.6	35.3	7.3	2.1	1918
8.2	4.3	17.1	1.7	26.8	8.4	1.7	1919
4.5	2.9	26.5	2.0	33.0	3.0	1.6	1920
4.0	2.3	32.1	1.8	32.9	2.7	2.7	1921
1.9	1.8	20.5	1.4	25.5	1.9	1.5	1922
2.4	1.5	18.7	1.6	23.8	1.6	1.6	1923
2.2	1.4	15.7	0.8	21.2	1.8	1.0	1924
1.8	1.7	15.4	1.2	19.0	2.0	1.3	1925
1.8	0.9	24.4	1.0	21.6	1.1	1.5	1926
1.1	1.5	22.9	1.1	19.8	0.9	2.0	1927
1.4	1.1	.	0.9	20.3	0.7	1.6	1928
1.0	1.1	19.9	0.7	16.9	0.9	1.3	1929
1.1	0.7	17.7	0.9	16.0	1.0	0.8	1930
0.8	1.4	16.2	0.6	15.2	0.7	0.9	1931
0.9	1.0	14.5	0.7	13.0	0.8	0.9	1932
0.9	0.6	16.5	0.6	13.6	0.6	0.8	1933
0.7	0.7	14.5	0.4	12.8	0.7	0.9	1934
1.0	0.8	14.8	0.9	11.4	0.8	0.8	1935
0.5	0.9	16.0	0.8	10.9	0.4	0.6	1936
0.6	0.3	17.7	0.3	20.2	0.7	0.6	1937
0.4	0.3	15.6	0.5	27.9	0.5	0.8	1938
0.4	0.1	15.7	0.5	21.6	0.5	0.7	1939
0.3	0.3	20.2	0.5	13.2	0.4	0.4	1940
0.4	0.4	20.5	0.4	16.1	0.5	0.4	1941
0.7	0.3	19.4	0.4	13.6	0.3	0.7	1942
0.9	0.5	22.6	0.4	11.4	0.2	0.6	1943
1.0	0.4	17.4	0.1	8.3	0.3	0.2	1944
7.4	0.6	16.2	0.2	8.6	0.5	1.3	1945
1.1	0.3	15.2	0.2	8.6	0.4	0.4	1946
0.6	0.3	10.6	0.1	6.6	0.6	0.5	1947
0.3	0.2	8.5	0.0	5.4	0.2	0.4	1948
0.3	-	8.5	0.0	5.7	0.1	0.3	1949
0.2	0.0	4.7	-	4.2	0.1	0.3	1950
0.2	-	2.7	0.2	.	0.0	0.1	1951
0.1	0.1	1.9	0.1	2.2	0.0	0.1	1952
0.1	-	1.5	0.2	1.6	-	0.2	1953
0.2	-	1.3	0.1	.	0.2	0.4	1954
0.1	0.1	1.0	0.2	.	0.0	0.2	1955

TABLE XII MORTALITY FROM DIPHTHERIA. ANNUAL DEATH RATE PER 100,000 POPULATION IN CERTAIN COUNTRIES 1901 - 1955

Year	EUROPE												
	Germany[1]	Belgium	Spain	France	Ireland	Iceland	Italy	Norway	Netherlands	Portugal	England & Wales	Scotland	N
1901	39.1	26.0	33.7	.	6.2	.	16.7	6.9	17.8	.	29.8	19.6	
1902	31.8	26.6	27.9	.	8.4	.	13.8	10.6	15.7	8.8	25.5	17.5	
1903	33.4	20.1	25.1	.	7.8	.	12.4	14.6	12.7	8.7	19.6	15.8	
1904	32.4	18.4	20.1	.	6.4	.	13.7	13.8	12.0	7.7	18.4	16.4	
1905	28.5	17.7	18.4	.	6.4	.	12.8	19.2	10.1	9.8	17.5	15.7	
1906	24.1	16.8	17.5	8.4	7.5	.	12.8	20.6	8.3	8.7	19.1	18.7	
1907	22.9	15.8	18.7	9.3	5.8	.	16.8	21.9	8.1	9.6	17.6	15.7	
1908	24.0	16.9	20.0	8.8	7.2	.	17.5	23.7	8.8	8.5	16.7	16.0	
1909	24.5	15.5	21.6	8.9	8.9	.	17.0	21.0	7.8	11.5	15.5	19.5	
1910	23.1	14.3	21.3	7.2	7.5	.	14.0	17.6	6.8	9.0	12.2	19.8	
1911	25.1	12.9	19.0	7.2	8.5	23.4	10.6	19.1	7.2	.	13.6	19.6	
1912	20.5	12.3	27.1	7.2	8.0	23.3	10.4	18.0	7.4	.	11.8	17.4	
1913	18.3	11.5	24.4	6.3	6.3	6.9	9.9	16.3	6.9	9.0	12.2	16.8	
1914	21.3	.	23.3	6.8	6.6	3.4	11.3	13.1	6.6	7.8	15.9	19.0	
1915	34.6	.	20.6	12.5	7.6	4.5	11.7	9.8	6.3	7.8	15.7	17.5	
1916	31.8	.	19.8	11.4	6.5	8.9	12.0	12.1	6.3	8.7	14.3	17.0	
1917	30.5	.	19.4	9.4	6.1	3.3	13.2	13.2	8.2	9.8	11.9	13.5	
1918	27.7	.	18.3	8.8	5.0	5.5	13.2	21.6	14.5	9.8	12.8	15.7	
1919	17.2	16.9	12.5	6.0	6.0	2.2	7.9	42.0	12.2	8.8	13.1	15.1	
1920	13.1	11.9	12.8	6.7	12.2	10.7	8.8	24.0	7.3	10.2	15.0	14.9	
1921	9.7	9.8	14.2	7.3	14.9	30.6	8.0	11.1	6.2	9.0	12.6	12.5	
1922	7.3	6.8	13.6	.	13.3	25.1	7.1	8.2	4.5	9.7	10.7	10.9	
1923	7.2	4.3	10.3	.	9.5	7.2	7.1	4.7	3.2	10.3	7.1	10.1	
1924	5.8	3.4	9.1	.	6.2	8.2	8.4	3.7	3.3	9.1	6.5	9.1	
1925	4.5	3.9	6.3	3.3	5.3	5.0	7.4	2.5	3.5	7.9	7.1	10.4	
1926	3.5	3.6	7.0	4.2	6.6	2.0	7.0	2.6	2.7	9.9	7.7	10.1	
1927	4.1	3.2	6.0	5.0	7.4	2.0	7.6	2.0	3.3	14.2	7.0	10.0	
1928	5.4	3.7	6.0	5.7	7.6	2.9	7.8	1.5	3.9	.	8.1	10.1	
1929	7.1	4.8	5.3	6.5	10.4	1.9	8.2	1.8	4.1	13.5	8.7	9.7	
1930	8.8	6.3	5.4	6.5	13.2	0.9	8.6	1.7	5.6	14.9	8.8	9.5	
1931	6.4	5.6	5.1	5.5	10.8	0.9	7.7	1.8	3.9	14.5	6.5	7.4	
1932	6.2	5.7	4.7	5.2	13.0	-	7.4	1.5	3.3	14.0	5.7	7.5	
1933	7.4	5.7	4.9	5.0	14.1	-	7.7	1.2	2.3	12.8	6.4	7.2	
1934	9.7	4.6	5.1	4.5	11.5	-	6.7	1.0	1.7	11.1	9.9	11.8	
1935	11.4	4.6	5.0	3.8	12.7	3.5	6.8	0.5	1.3	11.6	8.4	10.4	
1936	10.9	4.5	4.4	3.2	11.6	2.6	6.0	0.3	1.2	9.7	7.4	7.8	
1937	9.6	5.7	7.1	.	9.9	1.7	6.4	0.6	0.5	9.1	7.1	8.6	
1938	9.6	5.9	11.6	.	10.7	-	6.2	0.4	0.9	9.9	6.9	8.6	
1939	11.5	5.4	15.9	.	8.4	-	5.6	0.1	0.9	9.1	5.2	7.9	
1940	.	4.8	12.3	3.9	6.0	0.8	5.4	0.2	1.2	7.4	6.2	14.0	
1941	.	5.2	6.0	4.1	5.5	0.8	5.0	2.3	2.4	7.8	6.8	10.7	
1942	.	5.6	3.7	5.8	9.0	0.8	6.1	7.4	9.7	7.2	4.7	6.1	
1943	.	11.9	3.1	8.1	10.5	1.6	7.2	24.7	27.6	10.6	3.6	5.0	
1944	.	7.1	2.5	8.3	10.0	-	6.8	22.1	35.3	12.4	2.4	3.9	
1945	.	8.4	2.4	8.7	8.0	-	5.9	15.3	46.1	9.8	1.8	2.7	
1946	19.2	5.9	1.7	5.0	4.7	1.5	4.6	5.9	18.9	6.4	1.1	1.9	
1947	9.8	2.5	2.0	2.2	1.9	0.7	3.8	2.5	6.4	4.8	0.6	0.9	
1948	4.7	1.7	1.7	1.2	1.0	0.7	2.3	1.2	2.4	3.7	0.4	0.6	
1949	2.4	1.3	2.0	0.7	0.3	-	2.2	0.8	2.2	2.6	0.2	0.3	
1950	1.9	0.7	2.1	0.5	0.2	-	1.7	0.9	1.9	2.7	0.1	0.1	
1951	1.1	0.6	.	0.3	0.3	-	1.8	0.2	1.5	2.4	0.1	0.1	
1952	0.7	0.3	1.0	0.3	0.2	-	2.2	0.2	1.7	2.4	0.1	0.2	
1953	0.6	0.3	1.1	0.3	0.1	0.7	1.8	-	1.4	2.8	0.1	0.0	
1954	0.4	0.3	.	0.2	0.2	-	1.4	0.1	0.7	2.6	0.0	0.0	
1955	0.4	0.3	.	0.2	0.5	-	1.1	0.0	0.4	2.4	0.0	-	

[1] Federal Republic from 1946

TABLE XII (CONTINUED). MORTALITY FROM DIPHTHERIA ANNUAL DEATH RATE PER 100,000 POPULATION IN CERTAIN COUNTRIES, 1901 - 1955

		AFRICA	AMERICA				ASIA	OCEANIA		
weden	Switzerland	Egypt	Chile	United States[1]			Uruguay	Japan	Australia[2]	New Zealand[3]	Year
				All races	White	Non-White					
0.8	31.5	5.4	.	33.5	.	.	5.3	11.0	11.4	9.3	1901
3.8	21.5	4.0	.	29.8	.	.	2.6	9.9	8.0	8.6	1902
6.5	15.8	4.6	27.3	31.1	.	.	4.4	9.2	10.4	4.9	1903
5.7	17.5	5.4	15.0	29.3	.	.	9.1	8.2	13.1	4.7	1904
2.4	19.0	8.2	15.8	23.5	.	.	6.7	8.3	7.8	5.7	1905
1.6	14.5	7.5	14.2	26.3	.	.	4.5	8.9	7.6	5.0	1906
5.6	14.7	7.4	8.6	24.2	.	.	3.7	8.9	9.8	8.2	1907
1.9	15.5	6.7	8.0	21.9	.	.	4.2	10.5	10.0	5.2	1908
3.2	15.7	12.8	11.2	19.9	.	.	4.3	10.8	10.2	9.3	1909
4.5	12.2	9.9	5.6	21.1	.	.	4.6	11.0	12.7	8.3	1910
5.6	13.3	10.6	10.9	18.4	18.7	9.5	5.0	10.6	15.5	7.3	1911
4.0	11.0	11.1	3.9	17.6	17.9	9.6	3.7	9.7	16.2	4.9	1912
2.0	8.9	11.2	7.5	18.1	18.5	10.3	4.8	9.8	16.8	6.4	1913
4.2	9.6	10.7	7.0	17.2	17.5	9.6	4.6	9.1	14.5	8.0	1914
2.9	11.0	8.0	8.8	15.2	15.4	9.9	4.7	9.4	14.1	9.7	1915
1.3	10.3	5.9	5.6	13.9	14.3	9.0	3.7	7.7	18.1	15.9	1916
5.6	10.1	4.9	7.0	15.6	16.1	8.2	2.8	8.3	13.1	21.8	1917
0.7	14.9	10.1	6.5	14.0	14.6	6.7	5.9	7.4	12.8	17.7	1918
4.9	14.6	2.6	5.9	14.9	15.6	7.5	7.5	6.4	11.2	13.7	1919
1.2	17.4	2.4	6.2	15.3	16.0	8.6	10.4	6.9	15.5	8.0	1920
1.7	13.4	2.5	4.7	17.7	18.4	10.0	11.0	6.8	16.8	8.7	1921
5.4	8.1	3.1	3.6	14.6	15.1	10.2	5.1	6.2	9.7	6.2	1922
3.6	5.2	3.4	4.1	12.0	12.5	7.6	3.9	5.8	6.9	5.2	1923
3.2	4.6	5.0	2.9	9.3	9.6	6.4	2.7	6.0	7.5	6.2	1924
3.0	4.8	5.3	2.0	7.8	7.9	6.3	1.9	6.0	4.6	3.9	1925
3.0	2.9	4.4	2.5	7.4	7.5	6.7	2.2	6.0	5.3	4.9	1926
3.4	3.8	7.4	3.1	7.7	7.8	6.2	3.3	6.4	6.3	4.2	1927
2.4	5.0	7.6	2.4	7.2	7.3	6.4	4.8	7.0	6.9	5.2	1928
2.4	5.2	6.3	4.9	6.5	6.6	6.3	6.0	7.4	7.2	6.5	1929
2.3	5.5	5.8	5.3	4.9	4.9	4.9	7.1	6.3	6.0	4.1	1930
1.5	3.1	6.0	4.8	4.8	4.7	5.6	8.2	7.0	6.5	6.8	1931
0.9	2.2	5.9	6.0	4.4	4.5	3.7	11.7	6.8	6.5	2.8	1932
0.9	3.2	4.1	7.5	3.9	3.9	3.9	15.9	8.1	6.1	1.8	1933
0.7	2.2	5.8	9.3	3.3	3.3	3.3	19.1	7.7	6.3	1.8	1934
0.4	2.3	6.7	6.3	3.1	3.0	3.6	19.6	6.4	6.1	2.2	1935
0.4	1.1	5.3	5.1	2.4	2.3	3.2	15.7	6.2	6.7	1.3	1936
0.2	0.9	5.5	4.3	2.0	2.0	2.5	12.6	6.0	4.6	1.6	1937
0.1	1.2	4.6	4.0	2.0	1.9	2.5	10.7	5.8	4.5	2.0	1938
0.1	0.8	5.5	3.7	1.5	1.4	2.2	9.0	7.4	4.9	1.6	1939
0.4	1.0	7.0	3.0	1.1	1.0	1.8	8.0	6.6	2.6	1.0	1940
0.3	1.4	11.2	3.5	1.0	0.9	1.7	9.7	6.8	4.3	1.1	1941
0.8	2.3	10.7	4.5	1.0	0.9	1.2	5.5	7.0	3.3	1.6	1942
1.6	3.5	8.9	5.2	0.9	0.9	1.0	6.2	9.6	3.8	2.1	1943
2.8	3.7	7.0	5.0	0.9	0.8	1.0	.	8.5	2.5	1.9	1944
2.0	4.8	6.3	4.6	1.2	1.2	1.4	3.4	11.2	2.5	2.6	1945
0.8	4.2	4.4	3.7	0.9	0.9	1.0	2.1	5.2	1.6	3.0	1946
0.4	4.3	3.1	3.4	0.6	0.5	0.8	2.5	4.3	1.2	1.2	1947
0.2	2.8	3.4	4.4	0.4	0.4	0.8	1.3	2.4	1.0	0.2	1948
0.1	1.4	3.0	4.4	0.4	0.3	0.7	0.5	2.0	1.0	0.3	1949
0.1	0.9	2.9	4.0	0.3	0.2	0.6	0.3	1.4	0.6	0.2	1950
0.0	0.4	2.9	4.2	0.2	0.2	0.5	0.3	1.1	0.7	0.2	1951
0.0	0.3	2.8	3.0	0.1	0.1	0.3	0.2	0.7	0.4	0.1	1952
0.0	0.2	2.9	2.4	0.1	0.1	0.3	0.3	1.0	0.6	0.2	1953
r	0.3	2.1	2.7	0.1	0.1	0.3	0.3	0.7	0.4	0.2	1954
-	0.2	1.8	1.8	0.1	0.1	0.3	0.3	1.0	0.4	0.1	1955

1 Death registration States up to 1932

2 Excluding full-blooded aborigines

3 Excluding Maoris

TABLE XIII MORTALITY FROM CHOLERA. ANNUAL DEATHS IN CERTAIN COUNTRIES, 1900 - 1955

Year	India and Pakistan	Burma	Ceylon	Thailand	Indo-China	Java	China[1]	Shanghai	Hong Kong	Korea	Malaya	Singapore	Year
1900	805,698	3,481	.	.	E	.	.	.	.	.	.	194	1900
1901	267,657	3,552	95	.	E	7,637	.	.	9	.	.	120	1901
1902	222,235	1,901	116	.	E	4,790	E	1,149	433	.	.	737	1902
1903	304,621	8,233	28	.	E	E	C	165	6	.	.	184	1903
1904	189,855	2,980	.	.	E	.	.	1	.	.	.	3	1904
1905	439,439	5,347	.	.	C	.	.	-	5	.	.	16	1905
1906	682,649	7,872	E	.	C	.	.	197	1	.	.	171	1906
1907	400,424	7,678	.	.	.	.	E	699	30	.	.	187	1907
1908	579,814	11,911	30	.	C	.	E	9	39	.	.	127	1908
1909	227,842	11,389	.	.	C	C	E	4	2	.	.	77	1909
1910	428,440	2,011	.	.	.	.	E	-	7	.	.	130	1910
1911	349,814	4,191	277	E	3,833	.	.	-	3	.	.	235	1911
1912	400,583	7,186	.	E	12,028	5,511	E	1,321	1	.	.	114	1912
1913	290,476	4,339	.	E	281	2,040	C	-	40	.	.	79	1913
1914	278,657	2,073	.	.	489	1,144	C	350	16	.	.	211	1914
1915	386,875	17,597	.	.	6,326	1,118	C	-	11	.	.	5	1915
1916	286,374	1,673	.	.	6,987	1,108	E	100	10	.	.	8	1916
1917	265,088	1,914	.	78	1,439	327	.	-	-	.	.	7	1917
1918	556,553	4,269	.	42	1,456	9,864	.	-	-	-	233	-	1918
1919	565,166	13,260	419	10,277	4,798	8,861	E	680	42	11,084	237	58	1919
1920	126,744	3,396	-	2,748	1,035	17	E	144	6	13,568	14	32	1920
1921	446,817	3,791	-	40	2,838	1	C	122	5	1	-	1	1921
1922	118,632	5,047	-	80	992	28	142	101	-	23	-	1	1922
1923	71,514	1,488	-	108	143	-	67	94	1	-	C	-	1923
1924	285,624	8,083	14	61	73	-	2	-	-	-	C	4	1924
1925	113,713	1,932	89	2,076	96	-	E	99	2	-	C	-	1925
1926	131,969	6,182	54	7,133	14,425	-	E	466	1	159	C	1	1926
1927	300,182	4,528	3	1,138	24,201	10	.	124	3	-	74	14	1927
1928	344,096	7,209	3	1,379	4,905	1	.	9	-	-	-	8	1928
1929	287,464	7,970	19	2,084	3,955	-	E	135	-	15	-	-	1929
1930	336,661	661	-	84	2,406	-	.	5	-	-	-	-	1930
1931	220,375	534	6	16	1,582	-	.	27	-	-	-	-	1931
1932	66,137	1,082	-	13	363	-	E	205	156	38	-	-	1932
1933	68,139	179	-	22	190	-	.	-	-	-	-	-	1933
1934	198,886	822	1	6	94	-	.	2	-	-	-	-	1934
1935	210,304	8,858	22	917	86	-	.	-	-	-	-	-	1935
1936	158,736	985	44	3,134	61	-	.	-	-	-	-	-	1936
1937	99,054	3,492	2	5,957	8,892	-	.	696	1,082	1	-	-	1937
1938	236,143	586	-	3	8,626	-	.	2,106	383	32	-	-	1938
1939	97,566	1,468	5	9	.	-	.	57	448	.	.	.	1939
1940	88,133	5,916	1	148	314	-	43,135	45	626	.	.	.	1940
1941	228,141	.	3	-	39	-	71	49	.	.	.	.	1941
1942	218,496	.	42	-	14	-	9,521	136	.	.	.	.	1942
1943	459,930	.	47	1,410	.	-	6,318	-	.	.	.	.	1943
1944	294,525	.	9	1,076	.	-	350	-	.	.	.	.	1944
1945	278,498	6,220	5	3,954	.	-	5,201	143	.	.	.	.	1945
1946	122,817*	2,482	31	4,560	.	-	15,460	353	246	.	182	.	1946
1947	137,516	500	-	2,038	714	-	281	.	-	.	-	-	1947
1948	208,172	33	-	15	540	-	3	.	-	.	-	-	1948
1949	102,666	135	2	1	20	-	-	.	-	.	-	-	1949
1950	133,809	2,446	-	-	6	-	-	.	-	.	-	-	1950
1951	73,671	4,771	-	-	42	-	.	.	-	.	-	-	1951
1952	83,816	236	-	-	16	-	.	.	-	.	-	-	1952
1953	152,271	9	11	-	22	-	-	-	-	-	-	-	1953
1954	31,953	19	1	-	4	-	-	-	-	-	-	-	1954
1955	27,565	13	-	-	-	-	-	-	-	-	-	-	1955

TABLE XIII (CONTINUED) MORTALITY FROM CHOLERA

Year	Taiwan	Japan	Philippines	USSR	Egypt	Iraq	Iran	Syria	Austria	Belgium	Germany	Hungary	Italy	Spain	Year
1900	-	.	.	-	-	.	.	.	-	.	-	.	-	17	1900
1901	1	.	.	-	-	.	.	.	-	.	-	-	-	17	1901
1902	813	6,164	80,302	1,393	34,595	.	.	.	-	.	-	-	-	-	1902
1903	1	140	29,294	-	3	.	.	.	-	9	-	-	-	2	1903
1904	1	51	84	6,850	-	.	.	.	-	6	-	-	-	9	1904
1905	-	34	1,417	286	-	.	.	.	-	5	86	-	-	1	1905
1906	-	29	6,067	.	-	.	.	.	-	39	-	-	-	-	1906
1907	2	1,702	718	6,424	-	.	.	.	2	2	-	-	-	2	1907
1908	-	297	17,770	15,542	-	.	.	.	8	-	1	-	-	-	1908
1909	-	158	8,566	10,677	-	.	.	.	-	10	9	-	-	-	1909
1910	8	1,957	7,202	109,560	-	.	.	.	6	10	11	302	804	-	1910
1911	-	4	168	1,646	2	.	.	.	39	2	-	252	6,145	44	1911
1912	256	1,683	-	3	-	.	.	.	-	-	-	1	41	-	1912
1913	-	22	217	149	-	.	.	.	22	-	-	722	-	-	1913
1914	-	4	2,395	761	-	.	.	.	114	.	43	1,153	-	-	1914
1915	-	-	820	859	-	.	.	.	85	.	1,804	4,057	235	-	1915
1916	18	8,260	7,986	.	1	.	.	.	8	.	61	16	11	-	1916
1917	1	541	7,891	.	2	.	.	.	38	.	36	4	-	-	1917
1918	1	-	4,702	12,927	15	.	.	.	1	.	53	2	-	-	1918
1919	2,696	915	18,367	.	-	.	.	.	4	-	2	2	-	-	1919
1920	1,675	3,426	1,387	.	-	-	.	.	4	-	-	1	-	-	1920
1921	-	39	54	.	-	-	.	.	5	-	2	-	-	3	1921
1922	-	542	72	-	-	-	2	.	-	-	-	-	-	-	1922
1923	-	31	11	-	-	1,110	1,029	-	-	-	-	1	-	-	1923
1924	-	-	26	-	-	-	2	-	-	-	-	1	-	-	1924
1925	3	363	588	-	-	-	-	-	-	-	-	-	-	-	1925
1926	18	13	238	-	-	-	-	-	-	-	-	-	-	-	1926
1927	-	3	3	-	-	1,063	593	-	-	-	-	-	-	-	1927
1928	-	1	8	-	-	-	-	-	-	-	-	-	-	-	1928
1929	-	114	-	-	-	-	-	-	-	-	-	-	-	-	1929
1930	-	2	3,079	-	-	-	-	-	-	-	-	-	-	-	1930
1931	1	-	784	-	-	1,548	165	-	-	-	-	-	-	-	1931
1932	18	1	447	-	-	-	-	-	-	-	-	-	-	-	1932
1933	-	-	1,807	-	-	-	-	-	-	-	-	-	-	-	1933
1934	-	-	636	-	-	-	-	-	-	-	-	-	-	-	1934
1935	-	-	5	-	-	-	-	-	-	-	-	-	-	-	1935
1936	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1936
1937	-	11	1	-	-	-	-	-	-	-	-	-	-	-	1937
1938	-	10	-	-	-	-	-	-	-	-	-	-	-	-	1938
1939	-	1	-	-	-	-	307	-	-	-	-	-	-	-	1939
1940	-	5	-	-	-	-	-	-	-	-	-	-	-	-	1940
1941	-	-	.	-	-	-	-	-	-	-	-	-	-	-	1941
1942	-	-	.	-	-	-	-	-	-	-	-	-	-	-	1942
1943	E	1	.	-	-	-	-	-	-	-	-	-	-	-	1943
1944	.	-	.	-	-	-	-	-	-	-	-	-	-	-	1944
1945	.	-	.	-	-	-	-	-	-	-	-	-	-	-	1945
1946	2,210	528	-	-	-	-	-	-	-	-	-	-	-	-	1946
1947	-	-	-	-	20,462	-	-	18	-	-	-	-	-	-	1947
1948	-	-	-	-	10	-	-	-	-	-	-	-	-	-	1948
1949	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1949
1950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1950
1951	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1951
1952	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1952
1953	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1953
1954	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1954
1955	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1955

E = Cholera in epidemic form
. = Figures not available
- = No cholera death recorded

TABLE XIV MORTALITY FROM SMALLPOX. ANNUAL DEATHS IN CERTAIN COUNTRIES, 1901 - 1955

Year	AFRICA	AMERICA					ASIA							OCEANIA	Year
	Egypt	Argentina	Chile	Colombia	United States[1]	Uruguay	Burma[2]	China (Taiwan)	India[2]	Indonesia[3]	Japan	Korea[4]	Philippines	Australia	
1901	544	.	.	.	1,085	158	2,468	.	87,310	.	7	.	.	.	1901
1902	280	.	.	.	2,111	241	1,565	.	113,688	.	24	.	.	.	1902
1903	565	.	445	.	1,382	5	1,266	.	91,773	.	25	.	.	.	1903
1904	1,093	.	1,739	.	709	30	1,311	.	53,423	.	154	.	.	.	1904
1905	851	.	8,786	.	308	135	5,623	.	64,801	.	70	.	.	.	1905
1906	409	.	3,341	.	95	9	8,540	.	101,041	.	99	.	.	.	1906
1907	573	.	858	.	74	4	2,882	.	101,106	.	211	.	.	-	1907
1908	620	.	421	.	92	2	1,298	.	169,396	.	4,265	476	.	-	1908
1909	1,023	.	3,172	.	79	105	1,011	.	100,141	.	36	962	.	1	1909
1910	648	.	1,760	.	202	593	1,817	.	49,498	.	15	481	.	4	1910
1911	737	3,958	4,473	.	130	37	6,004	.	52,531	.	22	551	.	1	1911
1912	456	296	1,939	.	165	-	7,959	.	81,398	4,524	119	164	.	-	1912
1913	706	83	1,826	.	125	1	2,816	-	95,339	8,397	53	35	.	1	1913
1914	1,568	17	1,133	.	212	-	258	10	76,332	2,967	106	12	438	3	1914
1915	1,262	16	214	751	169	-	217	29	83,065	1,039	4	8	273	1	1915
1916	802	52	33	1,167	114	-	707	-	59,935	398	42	6	250	1	1916
1917	409	172	41	264	204	1	559	-	61,718	263	935	6	388	-	1917
1918	347	11	32	365	339	1	750	40	92,326	909	234	111	15,158	-	1918
1919	1,938	6	14	716	358	-	3,917	48	132,160	955	938	700	49,915	-	1919
1920	805	7	30	426	508	2	2,853	240	98,476	467	729	3,614	6,627	-	1920
1921	24	1,022	5,234	.	641	15	987	2	39,459	274	203	2,527	728	2	1921
1922	90	988	4,290	.	628	-	1,439	15	39,397	275	120	1,160	19	2	1922
1923	145	149	1,808	203	131	16	2,846	-	41,238	686	399	1,120	4	-	1923
1924	221	28	269	731	874	7	2,501	-	52,879	1,304	294	85	6	-	1924
1925	158	32	26	.	709	-	3,852	2	82,134	508	69	170	1	-	1925
1926	542	7	15	.	377	-	2,339	12	114,727	99	158	237	7	1	1926
1927	34	23	14	444	145	-	1,704	-	116,493	8	90	149	-	-	1927
1928	4	12	14	524	131	-	2,825	-	93,298	11	100	83	-	-	1928
1929	4	10	11	254	151	-	1,841	-	71,043	69	11	126	59	-	1929
1930	-	25	2	308	165	-	921	8	71,892	85	4	323	49	2	1930
1931	-	.	5	206	95	-	490	-	36,782	8	8	343	1	-	1931
1932	142	.	-	.	38	-	2,484	8	42,441	2	44	544	-	1	1932
1933	976	.	-	.	39	1	1,506	1	102,135	-	55	966	-	-	1933
1934	252	.	-	.	24	-	1,606	-	82,327	-	35	135	-	-	1934
1935	19	.	1	175	25	-	1,262	1	89,441	-	16	324	-	-	1935
1936	1	32	-	640	35	1	1,354	-	103,451	1	20	371	-	-	1936
1937	-	5	5	.	34	9	1,370	-	54,810	1	8	44	-	-	1937
1938	-	.	-	390	48	1	304	-	39,844	2	6	10	1	1	1938
1939	-	1	-	313	41	-	125	-	48,103	-	33	179	.	-	1939
1940	-	.	-	168	14	1	3,470	-	72,876	-	60	629	.	-	1940
1941	-	.	-	81	12	-	.	-	59,307	.	92	1,061	.	-	1941
1942	-	31	-	88	2	-	.	-	27,137	.	61	404	.	-	1942
1943	384	4	-	136	8	-	.	.	52,374	.	73	383	.	-	1943
1944	1,016	9	9	403	9	-	.	.	216,538	.	44	464	.	-	1944
1945	115	-	-	442	12	-	.	.	137,086	.	319	.	.	-	1945
1946	50	21	-	396	25	-	1,563	315	52,049	.	3,029	4,234	.	-	1946
1947	18	1	-	489	5	1	1,481	1,725	26,559	.	85	220	-	-	1947
1948	4	2	-	463	5	-	1,683	50	42,442	93	3	-	103	-	1948
1949	1	17	2	199	2	-	1,233	173	34,178	1,911	14	2,068	6	-	1949
1950	-	46	31	180	1	1	3,853	27	83,384	13,592	2	382	-	-	1950
1951	2	26	4	218	1	-	755	-	132,680	18,553	12	11,530	-	-	1951
1952	-	12	5	242	-	-	989	-	54,100	679	-	277	-	-	1952
1953	1	4	2	408	1	-	18	-	32,771	363	-	571	-	-	1953
1954	-	31	4	282	-	-	32	1	37,254	277	-	122	-	-	1954
1955	.	3	-	203	-	2	319	-	31,702	469	-	-	-	-	1955

TABLE XIV (CONTINUED). MORTALITY FROM SMALLPOX. ANNUAL DEATHS IN CERTAIN COUNTRIES, 1901 - 1955

Year	EUROPE													Year
	Belgium	Finland	France	Germany[1]	Italy	Netherlands	Norway	Portugal	Spain	Sweden	Switzerland	England & Wales	Scotland	
1901	260	103	.	54	3,396	7	-	.	5,250	-	37	356	278	1901
1902	652	72	.	15	2,413	5	-	716	5,590	1	2	2,464	80	1902
1903	1,630	35	.	20	6,049	22	-	1,629	4,699	2	4	760	41	1903
1904	656	36	.	25	3,093	11	-	444	2,859	1	4	507	185	1904
1905	244	18	.	38	482	13	6	1,773	2,740	3	36	116	4	1905
1906	41	29	631	47	169	6	-	4,116	4,342	-	14	21	1	1906
1907	55	23	2,679	68	451	6	-	2,648	3,234	-	8	10	1	1907
1908	42	24	171	62	559	1	19	700	2,796	1	2	12	6	1908
1909	40	61	87	23	758	-	2	1,085	3,965	-	3	21	-	1909
1910	68	70	78	34	413	-	-	1,197	2,103	-	2	19	-	1910
1911	46	59	70	35	4,828	-	-	.	1,512	-	11	23	5	1911
1912	58	9	102	35	3,336	1	-	.	2,516	-	3	9	17	1912
1913	44	11	431	12	150	4	-	292	3,100	2	-	10	-	1913
1914	.	33	144	19	45	1	2	235	2,244	1	-	4	1	1914
1915	.	37	103	20	19	1	-	138	1,770	-	2	13	2	1915
1916	.	192	105	91	16	8	-	59	2,110	2	-	18	1	1916
1917	.	194	75	448	114	-	2	18	2,565	25	-	3	-	1917
1918	.	752	134	60	924	-	-	4,338	2,969	1	-	2	-	1918
1919	31	430	159	704	16,380	-	-	8,864	3,623	1	-	28	-	1919
1920	45	18	113	662	11,037	3	-	1,208	3,285	3	-	30	152	1920
1921	12	2	96	109	1,360	-	-	267	2,097	-	7	5	24	1921
1922	15	7	.	26	37	-	-	425	1,325	1	3	27	-	1922
1923	30	-	.	10	16	-	-	660	525	-	2	7	-	1923
1924	16	2	.	6	46	-	-	751	1,217	-	2	13	-	1924
1925	19	1	113	9	13	-	-	468	849	-	1	9	-	1925
1926	14	-	115	-	10	1	-	394	112	1	1	18	-	1926
1927	18	-	119	3	5	-	-	385	162	-	-	47	-	1927
1928	8	1	16	-	21	-	-	.	153	-	-	53	-	1928
1929	16	1	22	-	3	21	-	115	2	-	-	39	-	1929
1930	11	-	19	-	2	-	-	135	4	1	-	28	2	1930
1931	-	-	14	-	4	-	-	580	8	-	-	9	-	1931
1932	-	1	24	-	2	-	1	1,031	6	1	-	3	-	1932
1933	-	2	27	-	2	-	-	529	2	-	-	2	-	1933
1934	-	-	19	-	3	-	-	221	5	-	-	6	-	1934
1935	-	1	15	-	1	-	-	212	3	-	-	-	-	1935
1936	-	7	10	-	-	-	-	157	2	-	-	-	-	1936
1937	-	1	.	-	1	-	-	105	6	-	-	-	-	1937
1938	-	-	.	-	-	-	-	172	6	-	-	3	-	1938
1939	-	-	.	-	1	-	-	266	609	-	-	-	-	1939
1940	-	-	1	-	-	-	-	92	977	-	-	-	-	1940
1941	-	1	1	-	1	-	-	85	176	-	-	-	-	1941
1942	-	-	6	-	-	-	-	119	31	-	-	-	25	1942
1943	-	-	1	1	3	-	-	45	-	-	-	-	-	1943
1944	-	-	4	-	81	1	-	74	3	-	-	3	-	1944
1945	-	-	1	.	190	3	-	46	2	1	-	-	-	1945
1946	5	-	3	.	25	-	-	100	1	-	-	11	-	1946
1947	8	-	6	-	1	2	-	52	1	-	-	15	-	1947
1948	9	-	-	-	1	-	-	22	1	-	-	-	-	1948
1949	2	-	-	1	-	-	-	11	2	-	-	5	-	1949
1950	2	-	-	-	-	-	1	2	2	1	-	-	6	1950
1951	-	-	.	-	-	2	-	3	-	-	-	10	-	1951
1952	-	-	5	-	-	-	-	1	-	-	-	1	-	1952
1953	-	-	-	-	-	-	-	1	-	-	-	8	-	1953
1954	-	-	-	-	-	-	-	-	-	-	-	-	-	1954
1955	-	-	18	-	-	-	-	-	-	-	-	-	-	1955

[1] From 1947, Federal Republic only

TABLE XV MORTALITY FROM WHOOPING COUGH. ANNUAL DEATH RATE PER 100,000 POPULATION IN CERTAIN COUNTRIES, 1901 - 1955

Year	EUROPE																Year
	Germany[1]	Belgium	Spain	France	Ireland	Iceland	Italy	Malta & Gozo	Norway	Netherlands	Portugal	England & Wales	Scotland	N. Ireland	Sweden	Switzerland	
1901	36.3	35.1	20.8	.	23.2	.	21.3	.	15.0	23.2	.	31.3	61.4	30.5	17.1	25.3	1901
1902	34.0	38.8	22.5	.	20.5	.	22.0	.	20.3	19.8	17.8	29.8	39.2	28.0	20.9	15.1	1902
1903	29.9	39.5	24.0	.	22.4	.	19.9	.	19.2	16.0	17.8	28.6	42.9	28.1	18.3	16.4	1903
1904	30.3	41.7	23.9	.	29.2	.	18.0	.	6.1	25.8	15.2	35.3	52.7	50.4	16.9	24.1	1904
1905	31.7	38.0	22.8	.	13.0	.	17.4	.	20.3	22.1	13.6	25.6	48.8	13.7	14.5	18.6	1905
1906	29.7	35.6	22.9	8.9	11.7	.	18.5	.	18.5	17.8	13.9	24.2	29.5	44.9	16.6	18.2	1906
1907	20.9	32.6	17.4	9.0	19.5	..	18.3	.	10.9	18.1	12.5	29.6	53.4	15.8	11.8	12.0	1907
1908	26.4	36.7	24.7	8.9	19.3	.	16.4	.	10.0	22.9	14.0	28.0	45.8	27.1	17.8	13.4	1908
1909	24.1	28.5	17.9	6.6	24.3	.	15.3	.	23.5	17.1	12.7	20.3	47.0	32.9	13.8	22.9	1909
1910	22.1	33.1	12.5	8.9	25.4	.	15.8	.	13.0	17.9	8.3	24.6	21.1	40.0	13.0	19.8	1910
1911	18.6	28.0	13.2	7.4	17.0	-	19.7	.	13.9	18.5	.	21.7	49.4	22.7	12.6	10.4	1911
1912	20.9	25.5	12.4	6.0	16.2	-	19.2	.	5.4	19.4	.	23.0	30.1	43.2	19.8	11.7	1912
1913	17.6	24.5	14.5	7.8	15.7	-	13.9	.	6.0	13.5	15.5	14.9	38.5	10.5	13.4	14.2	1913
1914	15.9	.	10.3	5.6	14.7	107.3	10.8	.	16.5	14.9	8.9	21.8	28.3	24.0	10.8	11.3	1914
1915	18.6	.	11.0	6.2	15.8	35.0	15.7	.	15.7	19.3	11.1	23.1	59.1	27.9	12.7	11.7	1915
1916	12.5	.	12.7	6.3	17.1	1.1	21.0	.	8.2	16.3	10.6	17.5	15.0	30.0	18.1	9.4	1918
1917	10.8	.	11.3	9.9	12.2	-	13.3	.	8.9	14.0	11.0	13.2	44.2	12.4	10.4	10.1	1917
1918	13.9	.	11.7	5.6	16.3	-	9.1	.	9.2	17.9	11.8	29.1	33.3	43.8	10.9	13.5	1918
1919	10.4	14.2	8.4	3.3	9.3	1.1	6.8	.	5.5	15.3	11.2	7.4	32.6	12.8	10.2	9.8	1919
1920	11.3	16.5	16.7	5.8	25.6	150.9	12.5	.	9.1	10.7	12.2	11.8	12.9	14.7	9.9	8.6	1920
1921	7.7	13.0	7.4	2.7	7.0	8.5	7.1	-	6.0	8.3	7.3	12.1	30.3	29.1	7.0	4.0	1921
1922	12.1	19.3	5.7	.	6.6	1.0	9.0	-	8.5	14.6	9.3	16.7	28.7	15.3	8.9	10.8	1922
1923	10.8	8.6	9.2	.	15.1	-	12.8	15.0	11.0	10.6	17.4	10.8	20.2	24.2	11.5	5.4	1923
1924	8.8	12.1	9.9	.	20.7	-	7.5	23.9	5.3	7.9	15.8	10.3	33.4	21.9	7.8	2.9	1924
1925	10.1	16.8	8.0	4.7	14.4	-	8.2	-	5.5	7.3	10.8	15.6	35.7	26.9	5.1	6.7	1925
1926	9.4	10.6	5.6	3.5	8.7	2.0	10.3	0.4	4.7	12.3	9.6	10.5	10.4	8.5	3.8	5.5	1926
1927	6.6	11.0	4.1	4.1	15.2	152.2	8.9	15.4	5.1	10.2	17.8	9.4	17.5	17.6	5.2	5.1	1927
1928	5.6	10.8	7.5	5.4	9.5	2.9	9.7	0.4	5.5	7.4	.	7.5	22.1	13.9	7.4	5.3	1928
1929	5.4	9.8	4.9	3.3	13.4	-	7.2	-	4.0	7.2	12.3	16.0	18.6	20.2	3.5	2.5	1929
1930	5.6	9.4	4.8	3.6	12.0	-	5.7	18.4	1.9	7.9	14.6	5.1	13.0	14.1	3.1	3.2	1930
1931	3.6	8.8	4.4	2.3	4.7	1.8	7.2	10.3	1.9	4.8	14.9	5.8	19.8	6.8	3.3	2.2	1931
1932	3.9	7.9	6.7	4.5	10.0	-	7.1	3.7	4.3	5.9	16.3	6.8	9.4	20.5	3.9	4.5	1932
1933	3.5	6.0	6.2	2.0	9.7	-	6.8	4.0	4.5	5.2	14.1	5.2	15.5	13.0	2.6	2.0	1933
1934	4.0	5.9	4.2	2.3	9.5	-	5.2	1.2	1.6	5.3	10.6	4.7	7.8	7.9	1.5	1.5	1934
1935	2.7	6.6	4.2	2.0	4.2	106.7	4.5	5.5	1.2	3.8	9.4	3.6	11.4	5.5	1.2	2.4	1935
1936	4.6	5.2	6.0	2.9	7.7	0.9	5.5	3.5	1.8	4.8	15.7	4.7	8.3	10.4	1.6	2.8	1936
1937	3.9	4.6	4.4	.	9.6	-	6.3	4.2	1.9	3.9	18.2	3.9	14.4	11.4	1.9	3.5	1937
1938	3.8	4.5	3.8	.	6.1	-	5.0	1.1	1.2	3.7	7.8	2.6	4.4	8.6	1.0	1.4	1938
1939	3.4	5.6	4.7	.	5.7	-	4.1	1.1	1.5	2.9	7.5	3.0	7.9	5.3	0.6	2.0	1939
1940	.	4.0	3.5	2.1	5.5	-	4.3	7.0	2.2	4.9	11.7	1.7	3.9	10.9	0.7	3.2	1940
1941	.	4.1	2.5	3.4	5.0	-	4.6	9.6	2.9	6.1	11.7	6.2	14.9	7.6	1.5	1.6	1941
1942	.	4.2	3.6	2.3	7.7	39.0	3.5	4.4	2.4	2.6	13.7	2.1	1.9	4.9	0.8	0.9	1942
1943	.	3.1	4.1	1.1	10.5	4.0	3.1	1.1	1.4	6.1	15.0	2.9	6.5	8.7	1.2	1.4	1943
1944	.	2.9	2.1	1.6	8.2	-	2.6	0.7	1.1	4.6	7.7	2.8	3.8	7.2	1.0	3.5	1944
1945	.	5.4	2.1	4.6	4.9	1.5	3.7	—	2.0	3.8	7.0	1.8	2.6	5.8	1.1	1.6	1945
1946	.	3.8	3.2	1.2	4.0	8.4	5.7	—	3.0	8.9	9.0	2.0	2.1	4.9	0.7	1.7	1946
1947	.	2.2	3.4	1.8	10.0	-	1.4	9.3	1.1	1.5	9.5	2.2	4.3	7.2	0.5	1.3	1947
1948	3.1	2.6	2.3	1.9	6.8	-	1.9	21.2	0.2	2.8	9.3	1.7	1.2	3.6	0.6	1.9	1948
1949	2.7	1.5	1.4	2.7	4.4	-	3.5	0.3	2.5	2.5	5.5	1.2	1.9	3.0	0.5	2.2	1949
1950	1.8	1.6	1.8	1.4	2.2	-	2.1	1.6	1.7	1.4	5.6	0.9	1.2	2.2	0.2	0.9	1950
1951	1.5	0.8	2.0	1.0	3.5	2.8	0.8	3.2	0.3	1.3	5.0	1.0	1.9	1.3	0.3	0.7	1951
1952	1.1	0.6	2.1	1.3	2.9	2.7	0.8	1.0	0.7	1.2	4.2	0.4	0.5	1.6	0.2	0.8	1952
1953	1.2	0.8	1.6	0.8	2.1	-	1.1	0.3	0.7	0.8	2.4	0.6	0.8	0.9	0.1	0.7	1953
1954	0.8	0.5	.	0.7	1.1	1.3	0.8	0.9	0.4	0.2	2.0	0.3	0.5	0.6	0.1	0.3	1954
1955	0.8	0.7	.	0.9	1.3	-	0.5	0.6	0.4	0.3	2.1	0.2	0.2	1.3	0.1	0.4	1955

[1] Federal Republic from 1946

Table XV (Continued) MORTALITY FROM WHOOPING COUGH. ANNUAL DEATH RATE PER 100,000 POPULATION IN CERTAIN COUNTRIES 1901-1955

Year	AMERICA					ASIA	OCEANIA		Year
	Chile	U S A[1]			Uruguay	Japan	Australia[2]	New Zealand[3]	
		All races	White	Non-White					
1901	.	8.7	.	.	6.8	3.2	.	1.2	1901
1902	.	12.4	.	.	2.4	4.1	.	10.4	1902
1903	50.5	14.3	.	.	7.0	4.6	.	24.9	1903
1904	49.1	5.8	.	.	2.9	5.2	.	4.1	1904
1905	65.5	8.9	.	.	1.1	5.9	.	0.3	1905
1906	95.4	16.1	.	.	4.8	6.8	7.2	2.9	1906
1907	76.2	11.3	.	.	3.6	6.7	25.9	33.4	1907
1908	67.7	10.7	.	.	2.3	8.2	5.9	4.4	1908
1909	67.4	10.0	.	.	3.0	7.5	6.0	4.2	1909
1910	50.8	11.6	11.0	35.9	3.3	8.2	10.9	14.9	1910
1911	53.4	11.0	10.5	24.5	3.8	9.1	6.5	1.7	1911
1912	98.7	9.2	8.7	22.9	4.7	9.1	6.5	1.0	1912
1913	66.7	10.1	9.6	22.4	1.0	9.8	11.6	12.0	1913
1914	45.4	10.2	9.1	33.9	0.5	9.9	6.5	6.8	1914
1915	71.5	8.2	7.7	17.9	6.8	9.2	3.7	7.3	1915
1916	70.3	10.5	9.5	25.3	8.4	10.7	8.6	8.9	1916
1917	82.7	10.5	9.3	26.1	3.1	11.9	5.7	4.0	1917
1918	51.1	17.0	14.9	44.3	2.0	10.4	4.7	2.4	1918
1919	37.9	5.6	4.9	12.2	2.6	11.2	4.1	0.6	1919
1920	79.1	12.5	11.7	20.6	4.8	14.2	10.5	9.0	1920
1921	82.0	9.1	8.0	20.4	2.8	12.3	7.8	4.0	1921
1922	42.3	5.5	4.9	11.7	3.5	11.0	3.3	0.3	1922
1923	29.8	9.6	8.3	22.4	2.7	14.7	2.1	3.1	1923
1924	49.4	8.1	6.7	21.8	6.5	17.5	7.2	3.6	1924
1925	55.1	6.7	5.9	15.2	6.8	14.3	7.8	1.2	1925
1926	46.4	8.8	8.0	17.2	1.9	12.1	5.6	8.0	1926
1927	49.0	6.8	5.6	19.3	3.3	15.0	6.1	3.0	1927
1928	39.6	5.4	4.6	12.4	3.5	18.3	3.8	1.9	1928
1929	50.7	6.2	5.4	13.7	1.3	15.6	5.4	1.2	1929
1930	42.6	4.8	4.1	11.1	2.0	11.6	5.1	2.3	1930
1931	29.9	3.9	3.3	8.7	4.8	12.7	4.7	2.5	1931
1932	38.7	4.5	3.9	10.0	2.6	22.2	2.3	3.0	1932
1933	53.5	3.6	2.9	9.2	1.4	9.2	1.9	1.2	1933
1934	50.5	5.9	5.0	14.7	4.2	12.5	6.6	2.7	1934
1935	48.1	3.7	3.2	8.3	6.9	17.7	2.4	2.8	1935
1936	44.7	2.1	1.8	4.9	3.7	14.0	3.8	3.1	1936
1937	32.9	3.9	3.4	7.9	5.0	15.6	2.6	0.9	1937
1938	28.2	3.7	3.0	9.3	1.8	12.5	2.1	1.4	1938
1939	25.2	2.3	1.8	7.0	3.0	14.2	1.2	0.1	1939
1940	43.8	2.2	1.8	5.9	2.6	12.2	3.8	1.5	1940
1941	25.2	2.8	2.3	7.3	2.4	14.9	3.2	4.4	1941
1942	11.1	1.9	1.5	5.3	2.3	12.9	2.6	0.3	1942
1943	32.9	2.5	2.1	6.3	3.3	.	2.8	1.1	1943
1944	30.0	1.4	1.1	4.5	9.2	.	0.8	2.9	1944
1945	16.0	1.3	1.1	3.2	5.5	.	1.1	0.5	1945
1946	15.7	0.9	0.7	2.1	5.8	.	1.0	0.1	1946
1947	21.4	1.4	1.0	4.2	5.4	21.8	1.0	2.0	1947
1948	21.4	0.8	0.6	2.6	6.1	5.9	0.8	0.3	1948
1949	23.2	0.5	0.4	1.5	2.7	11.1	0.9	1.2	1949
1950	9.6	0.7	0.5	2.7	5.9	10.1	0.4	0.9	1950
1951	15.5	0.6	0.3	3.1	.	4.6	0.4	0.4	1951
1952	12.0	0.3	0.1	1.2	1.0	2.8	0.3	0.4	1952
1953	7.7	0.2	0.1	0.6	1.3	1.6	0.3	0.3	1953
1954	8.1	0.2	0.2	0.9	3.3	2.1	0.2	0.3	1954
1955	11.1	0.3	0.2	1.4	1.6	0.5	0.1	0.1	1955

[1] Death registration States up to 1932

[2] Excluding full-blooded aborigines

[3] Excluding Maoris

TABLE XVI MORTALITY FROM TUBERCULOSIS OF THE RESPIRATORY SYSTEM. ANNUAL DEATH RATE PER 100,000 POPULATION IN CERTAIN COUNTRIES, 1901 - 1955

Year	EUROPE									
	Belgium	England & Wales	Finland	France	Germany[1]	Ireland	Italy	Netherlands	Norway	Portugal
1901	136.3	126.4	289.5	.	192.5	214.6	111.3	137.3	192.3	.
1902	132.8	123.4	301.2	.	186.7	211.8	101.2	132.5	186.8	100.1
1903	109.7	120.5	297.3	.	185.7	216.1	101.3	136.2	196.2	99.1
1904	110.3	124.4	310.5	.	182.1	222.7	107.5	130.9	195.4	103.0
1905	108.8	114.6	305.8	.	179.3	209.1	103.5	137.3	201.5	95.2
1906	107.0	115.7	281.9	182.1	162.4	202.9	102.2	135.2	195.7	94.0
1907	102.2	114.8	294.0	190.3	159.2	200.9	106.8	131.2	199.9	89.8
1908	102.5	112.7	304.5	186.3	153.6	193.9	106.0	121.0	186.5	94.2
1909	103.4	109.1	273.9	178.1	144.4	183.4	107.1	123.7	168.9	92.5
1910	97.7	101.5	275.7	178.7	140.0	171.6	102.9	119.0	170.3	94.0
1911	101.9	106.3	269.9	180.1	137.1	172.3	106.1	114.1	173.1	.
1912	94.3	102.6	281.9	175.8	131.5	167.7	94.9	106.6	172.5	.
1913	95.2	99.0	277.5	176.0	122.0	166.8	93.4	102.6	172.0	104.8
1914	.	102.4	274.5	180.6	122.3	162.4	93.1	103.4	173.5	104.7
1915	.	109.4	285.8	181.2	127.9	177.0	99.7	106.1	173.2	113.3
1916	.	108.9	294.0	177.5	139.2	168.2	103.4	121.1	181.0	114.9
1917	.	112.8	278.0	174.9	179.7	173.6	107.8	132.7	166.9	105.5
1918	.	121.0	275.7	203.3	202.5	167.7	136.7	153.8	162.5	132.2
1919	114.7	96.3	230.7	168.8	181.6	146.1	118.3	127.3	151.4	115.4
1920	88.7	87.2	233.9	150.5	130.3	128.1	112.6	105.4	165.1	123.4
1921	86.2	88.3	211.7	152.5	115.4	124.8	96.9	90.7	157.3	114.7
1922	87.1	88.8	223.8	.	120.4	122.4	98.3	81.9	161.6	122.8
1923	71.0	83.5	209.8	.	127.5	116.9	98.3	74.9	148.9	132.3
1924	70.5	84.3	235.5	.	100.6	122.9	115.9	74.9	159.3	141.1
1925	70.8	83.2	227.7	135.6	89.4	122.8	114.0	70.1	147.4	130.6
1926	68.1	77.0	208.9	139.6	82.0	113.4	108.4	71.5	128.3	136.2
1927	68.9	79.1	227.4	148.2	78.5	115.3	100.5	70.3	125.7	154.9
1928	67.2	75.5	214.6	140.0	73.0	108.3	94.1	61.2	125.4	.
1929	70.1	79.4	229.1	142.1	73.3	102.1	91.7	63.7	125.2	157.5
1930	68.6	73.9	218.1	135.8	66.2	101.3	82.1	54.8	121.1	159.9
1931	71.7	71.9	201.8	131.1	65.7	104.0	80.2	52.0	120.6	147.6
1932	64.1	66.6	191.0	119.1	62.5	96.9	76.9	45.2	110.5	138.4
1933	61.3	66.9	181.1	113.0	61.8	93.0	75.1	42.7	98.5	147.7
1934	56.5	61.5	171.9	108.7	60.5	91.8	69.5	39.1	92.2	138.6
1935	57.2	58.7	164.2	106.5	61.5	100.2	65.8	37.5	85.7	134.6
1936	56.2	56.4	189.1	103.0	59.7	91.8	64.0	36.0	81.1	132.2
1937	53.5	56.6	170.8	.	58.7	96.8	63.4	33.6	77.5	124.2
1938	52.6	51.6	171.5	.	53.2	85.1	59.1	27.1	72.5	127.4
1939	52.4	52.2	168.3	.	63.4	89.2	57.7	28.3	69.0	118.2
1940	53.6	58.8	181.4	116.6	.	98.3	56.6	30.8	65.5	128.2
1941	77.2	60.2	168.1	133.7	.	96.3	61.5	42.7	65.5	132.9
1942	73.8	54.2	189.5	128.1	.	118.5	78.3	44.0	59.2	134.8
1943	65.5	55.7	165.1	123.4	.	115.3	80.2	50.2	56.9	127.4
1944	65.5	52.4	164.9	108.5	.	99.7	79.1	54.5	62.1	122.7
1945	60.9	51.5	157.3	90.8	.	94.1	73.1	65.4	52.8	130.0
1946	51.9	46.8	152.9	67.6	67.8	87.2	64.3	32.6	53.3	135.0
1947	50.7	47.3	143.4	63.4	59.6	95.3	60.8	26.2	46.1	131.4
1948	44.1	44.0	133.2	61.9	56.5	81.8	47.8	21.3	43.0	126.8
1949	36.2	40.5	111.6	55.4	41.5	71.9	37.6	18.1	31.9	126.6
1950	34.1	32.1	78.6	47.7	32.7	63.2	33.3	13.8	23.9	118.7
1951	31.0	27.5	73.2	50.8	31.3	56.4	34.6	12.4	20.1	109.4
1952	22.6	21.2	50.7	36.7	23.5	40.9	21.5	9.5	16.9	78.0
1953	25.4	17.9	40.7	31.4	19.0	30.9	19.7	7.2	13.5	50.4
1954	23.3	16.0	37.0	28.1	18.3	27.2	19.3	6.2	13.0	50.6
1955	22.8	13.1	39.0	27.5	18.2	25.1	19.3	5.5	10.8	52.5

[1] Federal Republic from 1946

TABLE XVI (CONTINUED) MORTALITY FROM TUBERCULOSIS OF THE RESPIRATORY SYSTEM. ANNUAL DEATH RATE PER 100,000 POPULATION IN CERTAIN COUNTRIES, 1901 - 1955

				AMERICA		ASIA	OCEANIA		Year
Scotland	Spain	Sweden	Switzerland	U.S.A.[1]	Uruguay	Japan	Australia[2]	New Zealand[3]	
146.7	153.4	.	188.8	169.4	.	138.8	.	76.6	1901
145.8	148.8	.	187.0	154.4	.	145.8	.	77.3	1902
146.2	143.1	.	187.3	155.6	100.6	147.7	.	69.5	1903
147.6	149.6	.	187.1	165.8	.	149.0	.	70.8	1904
138.8	139.7	.	190.6	157.1	91.6	162.4	.	57.0	1905
140.5	142.2	.	182.2	153.3	109.8	159.8	.	62.1	1906
138.0	138.8	.	170.6	152.0	104.5	158.4	78.4	66.6	1907
129.9	135.9	.	170.7	140.1	101.4	159.3	80.4	71.0	1908
127.4	125.3	.	164.9	134.9	114.4	169.1	73.5	65.2	1909
114.1	123.6	.	163.3	133.3	111.1	166.9	69.1	57.8	1910
114.7	122.4	159.5	157.6	134.2	124.2	160.8	69.4	55.5	1911
111.9	116.6	163.1	145.3	125.9	116.7	161.1	66.6	53.2	1912
107.9	119.9	154.7	143.7	123.7	105.9	155.3	66.3	59.9	1913
103.6	123.2	162.4	139.9	123.0	118.3	155.4	62.2	51.7	1914
110.9	127.4	171.0	137.2	122.6	119.5	156.7	60.5	49.7	1915
106.9	129.6	171.6	135.9	121.0	144.6	161.0	63.7	51.4	1916
136.6	136.6	161.9	149.9	126.2	133.4	161.6	57.2	53.1	1917
108.4	162.0	149.4	150.1	132.9	143.4	180.8	59.5	57.8	1918
89.1	140.9	136.9	148.2	111.3	136.8	168.5	65.8	51.3	1919
86.2	140.7	132.4	132.3	99.8	132.7	156.3	56.6	56.3	1920
81.3	125.3	131.3	122.0	84.5	122.2	147.2	57.8	49.8	1921
82.9	126.2	126.9	122.0	83.3	122.3	149.8	52.3	47.5	1922
81.8	124.6	116.3	116.5	80.4	115.0	140.9	53.4	48.6	1923
79.9	124.9	123.5	114.1	76.5	121.5	135.6	52.7	44.2	1924
76.7	122.0	120.9	116.6	74.1	133.7	137.4	50.4	42.2	1925
69.6	118.6	112.3	111.6	74.9	124.7	133.5	51.9	43.8	1926
71.4	116.3	115.1	108.4	70.1	121.7	139.9	49.0	38.8	1927
68.4	108.8	108.5	103.7	69.3	116.4	138.4	50.8	40.9	1928
68.0	108.2	107.9	102.2	67.0	125.4	140.4	46.9	37.3	1929
62.6	100.0	105.8	96.1	63.0	120.5	134.6	44.1	37.2	1930
62.0	103.3	107.1	93.2	60.4	122.2	136.5	43.3	34.7	1931
61.3	92.7	95.9	86.7	56.1	112.2	131.9	40.5	33.6	1932
59.6	93.2	87.5	80.3	53.7	112.3	139.3	39.2	32.5	1933
56.6	88.2	87.2	77.2	51.2	112.2	142.2	38.7	33.3	1934
56.8	86.0	81.9	74.5	49.9	101.1	140.7	37.9	31.8	1935
55.4	81.2	79.5	74.0	50.8	97.5	152.5	37.4	36.2	1936
56.1	95.5	73.0	66.8	49.2	97.0	147.3	36.0	32.9	1937
51.7	105.0	69.7	62.8	44.7	103.5	148.8	34.8	31.7	1938
54.3	99.3	64.5	61.6	43.1	88.7	154.1	35.3	33.9	1939
60.0	91.2	60.9	58.5	42.2	95.0	154.1	33.2	32.4	1940
64.7	102.7	63.1	59.5	40.9	88.2	158.1	35.0	31.9	1941
64.0	99.5	57.2	62.5	39.6	95.1	167.1	35.7	31.8	1942
63.8	92.0	59.1	58.3	39.1	99.9	179.6	31.4	30.9	1943
64.0	91.1	57.1	62.6	38.2	97.1	.	29.6	31.2	1944
62.7	90.4	58.0	65.2	37.0	92.9	.	29.6	31.2	1945
65.9	96.4	46.9	59.6	33.6	90.7	.	29.5	27.7	1946
66.0	100.4	45.0	53.1	31.0	89.1	156.4	27.5	26.0	1947
66.1	92.1	35.9	41.2	27.7	80.1	150.9	26.0	23.6	1948
59.8	93.2	25.1	32.6	24.2	62.7	140.6	22.7	20.6	1949
47.1	82.8	18.9	27.8	20.6	55.0	121.8	19.1	19.5	1950
36.9	73.2	20.5	28.7	17.6	48.5	91.1	16.7	17.4	1951
27.6	43.8	15.3	19.7	14.7	33.9	67.4	13.5	12.0	1952
22.6	31.6	12.7	18.7	11.3	24.3	55.4	10.0	9.5	1953
19.7	30.3	11.6	17.5	10.1	20.1	53.1	9.2	9.2	1954
16.8	28.7	9.5	17.5	8.3	22.1	45.1	7.3	9.7	1955

1 Death Registration States up to 1932 2 Excluding full-blooded aborigines 3 Excluding Maoris

TABLE XVII MORTALITY FROM SUICIDE. ANNUAL DEATH

Year	AMERICA				ASIA									EUR
	Chile	USA[1]			Japan	Belgium	Denmark	Finland	France	Germany[2]	Ireland[3]	Italy	Nethe	
		All races	White	Non-White										
1901	.	10.4	.	.	17.6	12.7	.	6.1	.	20 8	2.9	6.2	5.	
1902	.	10.3	.	.	17.9	12.8	.	5.6	.	21.4	3.3	6.1	6.	
1903	.	11.3	.	.	19.2	11.8	.	5.3	.	21.7	3.3	5.9	6.	
1904	.	12.2	.	.	19.3	12.5	.	5.5	.	21.0	3.4	6.5	6.	
1905	.	13.5	.	.	17.3	13.0	.	5.9	.	21.3	3.6	7.2	7	
1906	.	12.8	.	.	16.2	11.9	.	6.5	20.4	20.4	3.3	7.0	6.	
1907	.	14.5	.	.	16.8	11.4	.	7.2	22.6	20.6	3.4	7.3	6	
1908	.	16.8	.	.	17.2	13.3	.	7.9	21.5	21.9	3.4	8.0	6	
1909	.	16.0	.	.	18.7	13.1	.	9.3	22.2	22.3	3.3	8.7	7	
1910	.	15.4	15.5	12.0	18.9	14.2	.	8.7	21.8	21.6	3.6	8.4	6	
1911	3.2	16.0	16.1	12.8	18.7	13.7	.	9.2	21.9	21.7	3.4	7.9	6	
1912	3.4	15.6	15.8	9.8	18.6	13.6	.	9.9	22.9	22.5	3.8	8.5	6	
1913	2.7	15.4	15.7	9.1	20.1	14.6	.	12.5	22.8	23.2	3.5	8.8	6	
1914	3.1	16.1	16.4	9.9	20.8	.	.	10.8	23.3	21.8	2.7	8.9	6	
1915	3.8	16.2	16.5	9.5	19.1	.	.	8.9	16.7	16.6	3.1	8.5	6	
1916	2.1	13.7	14.3	5.0	17.8	.	.	7.3	16.0	17.3	2.5	6.9	5	
1917	2.6	12.9	13.5	4.8	17.0	.	.	8.3	15.0	16.4	2.2	6.9	6	
1918	2.4	11.9	12.4	5.3	18.4	.	.	13.3	14.1	15.7	2.5	7.5	7	
1919	2.7	11.5	12.2	4.0	18.0	14.3	.	8.3	17.3	18.4	2.9	7.3	7	
1920	3.1	10.2	10.8	3.6	19.1	13.2	13.9	10.6	17.5	21.7	2.1	7.3	7	
1921	3.6	12.4	13.1	4.6	20.2	12.5	13.1	12.1	19.6	20.7	3.1	7.8	6	
1922	4.8	11.7	12.5	4.2	20.2	13.0	14.3	12.2	.	21.9	2.2	8.3	6	
1923	2.3	11.5	12.2	3.7	19.9	13.8	14.2	9.3	.	21.4	2.5	8.7	6	
1924	3.0	11.9	12.7	4.3	19.2	13.7	13.7	14.7	.	.	3.2	9.7	6	
1925	2.7	12.0	12.7	4.0	20.6	13.8	13.7	16.1	19.3	24.5	2.9	9.4	6	
1926	3.4	12.6	13.4	4.4	20.7	15.3	15.9	15.7	19.2	26.2	3.3	9.8	6	
1927	3.0	13.2	14.0	4.7	21.0	15.6	16.0	18.2	19.3	25.3	3.2	10.6	7	
1928	5.0	13.5	14.5	4.8	21.0	16.0	17.5	17.7	18.9	25.2	3.3	9.7	6	
1929	4.9	13.9	14.9	4.9	20.2	15.6	16.8	19.7	18.4	26.1	3.8	9.0	6	
1930	5.8	15.6	16.8	5.1	21.8	16.8	17.6	23.1	19.0	27.8	2.8	9.6	8	
1931	8.7	16.8	18.0	5.5	22.0	17.8	17.0	23.4	19.0	28.8	3.7	10.1	8	
1932	8.0	17.4	18.6	5.8	22.2	17.7	19.1	22.2	20.6	29.2	3.7	9.8	9	
1933	6.3	15.9	17.1	5.4	22.0	18.2	18.2	20.8	20.0	28.7	3.5	8.9	8	
1934	5.4	14.9	16.0	5.2	21.3	18.0	17.6	19.3	21.4	28.7	3.5	8.7	8	
1935	5.2	14.3	15.4	5.1	20.5	16.8	19.4	17.2	20.1	27.6	3.1	7.7	8	
1936	6.0	14.3	15.4	4.7	22.0	15.8	17.3	19.6	19.5	28.7	3.3	7.9	8	
1937	5.8	15.0	16.1	4.9	20.1	17.8	20.9	19.6	.	28.9	2.9	7.6	8	
1938	4.6	15.3	16.4	4.9	16.9	18.0	20.8	19.8	.	28.3	3.3	7.2	8	
1939	4.0	14.1	15.3	4.2	15.2	16.9	17.9	22.7	.	.	2.7	6.9	7	
1940	4.6	14.4	15.5	4.6	13.8	18.1	17.8	20.9	18.7	.	3.3	5.9	10	
1941	3.4	12.8	13.8	4.1	13.3	14.0	17.4	18.2	17.2	.	3.0	5.3	6	
1942	2.9	12.0	13.0	3.9	12.8	13.0	17.2	14.5	12.8	.	2.8	5.2	9	
1943	3.1	10.2	11.1	3.0	11.6	10.3	21.3	17.9	11.8	.	2.6	5.0	8	
1944	4.4	10.0	10.8	3.0	.	12.2	22.2	16.0	11.5	.	2.6	4.0	6	
1945	4.5	11.2	12.1	3.5	.	14.7	24.8	17.0	12.3	.	2.4	4.8	9	
1946	3.4	11.5	12.4	3.9	.	14.6	25.9	17.1	11.2	.	2.7	5.3	7	
1947	3.0	11.5	12.4	4.1	15.7	14.6	24.9	16.1	12.7	17.7	2.4	5.8	6	
1948	3.8	14.1	12.0	4.1	15.9	15.0	25.1	16.3	14.2	15.6	2.3	6.3	6	
1949	3.8	11.4	12.3	4.3	17.3	13.6	24.8	17.2	15.2	15.8	2.6	6.6	6	
1950	4.2	11.4	12.2	4.3	19.6	12.9	23.3	15.6	15.2	18.8	2.6	6.5	5	
1951	4.6	10.4	11.1	4.1	18.3	13.8	23.6	15.7	15.5	19.2	2.6	6.8	6	
1952	.	10.0	10.7	3.7	18.5	13.1	22.9	17.6	15.5	17.7	2.2	6.3	6	
1953	4.3	10.1	10.8	3.8	20.5	13.5	24.1	17.4	15.4	18.4	2.3	6.6	6	
1954	4.4	10.1	10.9	4.1	23.4	13.8	23.3	18.9	16.2	19.4	2.0	6.1	6	
1955	.	10.2	11.0	3.8	25.3	13.6	23.3	19.9	15.9	19 3	2.3	6.7	6	

[1] Death registration States up to 1932

[2] Federal Republic from 1946

[3] Including Northern Ireland up to 1921

[4] Excluding full-blooded aborigines

[5] Excluding Maoris

R 100,000 POPULATION IN CERTAIN COUNTRIES, 1901 - 1955

								OCEANIA		
Norway	Portugal	Spain	Sweden	Switzerland	England & Wales	Northern Ireland	Scotland	Australia[4]	New Zealand[5]	Year
5.5	.	2.0	13.1	22.4	9.6	.	5.3	.	10.2	1901
5.4	4.3	2.4	14.9	22.7	9.9	.	5.7	.	10.0	1902
5.6	4.5	2.0	13.3	22.7	10.5	.	6.0	.	12.8	1903
5.7	4.9	2.0	14.1	24.5	9.9	.	6.4	.	11.8	1904
5.0	5.0	2.3	15.3	22.5	10.4	.	6.6	.	10.2	1905
3.9	5.3	3.0	14.5	20.6	10.1	.	5.6	.	9.3	1906
5.2	5.0	2.6	15.5	23.0	10.2	.	5.9	11.2	11.1	1907
4.8	4.6	3.2	15.6	22.5	10.8	.	5.3	11.8	10.9	1908
4.9	5.5	3.5	16.8	22.6	10.1	.	5.2	11.6	12.1	1909
5.5	6.0	4.5	17.8	22.7	10.0	.	6.1	11.8	10.1	1910
4.8	.	4.5	17.6	23.7	9.9	4.3	5.3	12.1	12.2	1911
6.0	.	4.6	18.3	23.3	9.9	3.9	5.9	13.6	11.9	1912
5.8	8.7	5.5	17.9	24.7	9.6	4.2	5.9	13.4	13.8	1913
4.9	7.4	5.9	15.9	24.3	10.0	2.3	5.5	13.0	12.6	1914
5.3	7.5	6.2	15.4	21.5	7.8	4.4	5.0	13.2	10.3	1915
3.8	6.2	6.1	13.2	20.4	7.3	3.2	4.6	11.7	13.4	1916
3.6	7.0	6.0	10.2	18.0	6.4	3.7	4.3	10.1	13.3	1917
3.1	6.5	6.6	10.0	19.7	7.5	3.7	3.9	9.9	10.2	1918
4.8	5.9	5.2	13.6	20.5	8.8	3.8	4.9	10.5	12.2	1919
4.8	6.2	5.1	14.7	22.6	9.0	2.7	4.9	11.9	11.2	1920
5.8	6.0	5.2	15.3	22.8	9.9	4.7	5.6	11.4	12.8	1921
5.6	7.2	5.1	14.4	23.9	10.1	4.5	5.6	9.6	13.1	1922
6.2	6.5	5.7	14.2	23.5	10.3	4.0	8.7	10.5	10.4	1923
5.8	7.7	6.2	14.5	23.8	9.6	5.4	7.4	11.2	12.3	1924
5.4	6.9	5.8	13.5	21.9	10.5	6.0	7.6	11.8	13.0	1925
6.0	6.9	6.4	14.8	26.1	11.4	5.0	8.7	11.7	13.3	1926
5.6	7.7	4.3	15.1	24.6	12.5	6.4	10.4	12.0	14.5	1927
6.6	.	5.7	14.0	25.7	12.4	5.1	9.8	12.3	14.5	1928
6.5	6.6	6.1	15.4	24.4	12.6	5.7	9.8	12.3	15.7	1929
7.2	6.9	5.7	15.8	26.1	12.7	4.9	10.3	14.6	13.6	1930
6.9	10.2	6.7	16.5	24.8	12.9	5.1	10.2	12.7	15.7	1931
6.5	11.3	6.7	17.7	29.7	14.3	5.7	10.2	11.5	16.5	1932
6.2	11.7	5.0	17.1	27.3	14.0	5.6	10.6	11.9	13.7	1933
6.9	12.3	4.7	15.3	26.5	13.7	5.2	10.8	12.4	12.3	1934
6.4	11.9	4.6	15.5	26.4	12.9	4.0	9.4	11.8	10.1	1935
6.3	11.7	5.7	16.7	27.8	12.4	4.0	10.0	11.6	10.1	1936
6.8	10.6	4.3	15.6	23.9	12.6	5.2	9.1	10.5	11.1	1937
6.9	10.6	4.5	15.8	24.5	12.9	4.2	9.2	10.8	12.4	1938
6.7	12.8	7.4	16.2	23.8	12.1	5.2	9.2	11.2	11.7	1939
6.9	11.6	6.1	17.1	23.6	11.3	4.6	7.9	10.6	10.9	1940
4.2	11.9	6.9	15.8	24.4	9.4	4.3	7.8	8.8	9.3	1941
5.0	9.4	6.1	14.3	23.2	8.9	3.4	7.3	8.3	10.9	1942
5.7	8.9	5.6	15.1	23.8	9.3	4.0	7.3	7.1	8.6	1943
5.6	9.2	5.4	13.1	25.6	9.1	3.6	6.8	7.4	10.0	1944
9.2	9.6	5.0	15.3	27.8	9.6	2.1	6.2	7.7	11.0	1945
6.1	9.8	5.5	15.5	26.0	10.6	3.5	6.1	9.8	10.0	1946
6.5	8.8	5.1	14.8	25.2	10.5	3.4	5.6	9.8	8.0	1947
6.9	9.6	6.2	14.5	22.6	11.0	4.2	6.6	9.6	10.5	1948
8.7	10.6	6.2	18.3	23.8	11.0	4.1	5.7	9.8	9.7	1949
7.4	10.1	5.4	14.9	23.5	10.2	3.5	5.2	9.3	9.2	1950
6.5	10.2	5.9	16.2	21.1	10.2	4.1	5.4	9.5	9.9	1951
6.9	.	5.9	16.7	21.5	9.9	3.0	5.5	10.6	10.1	1952
7.7	.	5.9	18.6	21.8	10.8	3.3	5.5	10.9	9.9	1953
7.4	.	.	17.0	22.6	11.4	3.5	5.9	10.8	9.8	1954
7.4	9.2	.	17.8	21.6	11.3	3.3	7.7	10.3	9.0	1955

APPENDIX I

SUGGESTED CHECK LIST OF BOOKS, REPORTS, DOCUMENTS, PERIODICALS, ETC. FOR THE LIBRARY OF A STATISTICS UNIT IN A HEALTH DEPARTMENT AND ADDRESSES OF SOME FIRMS DEALING IN STATISTICAL EQUIPMENT

(The prices indicated against each publication are subject to change)

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1. Vital and health statistics and population data

1.1 Books

* United Nations Handbook on Vital Statistics Methods. Studies in Methods, Series F, No. 7, Statistical Office of the United Nations, New York, 1955. Price US $2.50

United Nations Handbook of Statistical Organization. Studies in Methods, Series F, No. 6, Statistical Office of the United Nations, New York, 1954. Price US $1.50

* WHO Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death, Seventh Revision, Vols. 1 & 2. Geneva, 1957. Available in English, French and Spanish, price US $6.75

Diagnostic Index Coding, Section I, Part IV. Veterans Administration Department of Medicine and Surgery Manual, M-3, January 1957, Washington D.C.

The Determinants and Consequences of Population Trends. Population Studies No. 7, (ST/SOA/Ser. A/7) UN Department of Social Affairs, United Nations, New York, 1953. Price US $4.00

Handbook of Statistical Methods for Demographers; Selected Problems in the Analysis of Census data, by A. J. Jaffe. United States Bureau of the Census, United States Government Printing Office, Washington D.C.

Practical Statistics in Health and Medical Work, by Ruth R. Puffer. McGraw Hill Book Co., New York, 1950. Price US $4.50

Public Health Statistics, by Marguerite F. Hall. P. & B. Hoeber, Inc., New York, 1949. Price US $7.50

An Introduction to Medical Statistics, by H. M. Woods & W. T. Russell. Staples Press, London, 2nd ed. 1936. Price 8s. 6d.

Vital Statistics Rates in the United States, 1900-1940, by Forrest E. Linder & Robert D. Grove. US Public Health Service, National Office of Vital Statistics, US Government Printing Office, Washington 25, D.C., 1947. Price US $2.50

* Physicians' Handbook on Death and Birth Registration, 11th Edition. US Public Health Service, US Government Printing Office, Washington 25, D.C., 1958. Price US $0.15

Vital Statistics and Public Health Work in the Tropics, including supplement on the genealogy of vital statistics, by P. Granville Edge. Baillière, Tindall and Cox, London, 1947. Price 15s.

Introduction to Demography, by M. Spiegelman. Society of Actuaries, Chicago, Ill, 1955. Price US $6.50

Measurements of the Public Health, by F. A. E. Crew. Oliver & Boyd, London, 1948. Price 18s.

* United Nations Multilingual Demographic Dictionary. Population Studies No. 29, ST/SOA/Series A 29, New York, 1959. Price US $0.50

Training in Techniques of Demographic Analysis, United Nations Population Studies No. 18, ST/SOA/Series A 18, New York, 1953. Price US $0.25.

Length of Life, by L. I. Dublin, A. J. Lotka & M. Spiegelman. Ronald Press Co., New York, 1949. Price US $7.00

Life Tables from Limited Data: A Demographic Approach, by G. J. Stolnitz. Princeton, N. J., 1956. Price US $4.00

The Facts of Life, by Louis I. Dublin. The Macmillan Co., New York, 1951. Price US $4.95

The Cost of Sickness and the Price of Health, by C.-E. A. Winslow. WHO Monograph Series No. 7, 1951, Geneva. Price US $1.50

American Hospital Association Handbook of Accounting, Statistics and Business Office Procedures for Hospitals: Section I, Hospital Statistics and Uniform Classification of Accounts. Chicago, The Association, 1950. Price US $2.50

The Burden of Diseases in the United States, by A. E. Cohn & C. Lingg. Oxford University Press, New York, 1950. Price US $10.00; Oxford University Press, London, 1951. Price 80s.

Vital Statistics, by William A. Farr. Memorial Volume of Selections edited by Noel A. Humphreys. Office of the Sanitary Institute, London, 1885

Techniques of Population Analysis, by George W. Barclay. John Wiley and Sons Inc., New York, 1958. Price US $4.75

* Elements of Vital Statistics, by B. Benjamin. George Allen & Unwin Ltd. London, 1959. Price 56s.

Infant Mortality in India 1901-1955, by S. Chandrasekhar. George Allen and Unwin Ltd. London, 1959. Price 20s.

The Future Growth of World Population. ST/SOA/Series A/28, United Nations, New York, 1958. Price US $0.80.

Methods of using Census Statistics for the Calculation of Life Tables and Other Demographic Measures. ST/SOA/Series A/7. United Nations, New York, 1950. Price US $0.60

Survey of Social Statistics. ST/STAT/Series K/1. United Nations, New York, 1954. Price US $0.40

Introduction to Medical Biometry and Statistics, by Raymond Pearl. Third edition revised and enlarged, 1940, Saunders, Toronto

Vital Statistics, by George C. Whipple. Second edition revised and enlarged, 1923, Chapman & Hall, London

1.2 **Technical reports and documents on vital and health statistics**

* Principles for a Vital Statistics System. ST/STAT/Series M/19. United Nations, New York, 1953. Price US $0.30

* Principles and Recommendations for National Population Censuses. ST/STAT/Series M/27. United Nations, New York, 1958. Price US $0.30

* General Principles for a Housing Census. ST/STAT/Series M/28. United Nations, New York, 1958. Price US $0.20

* Handbook of Population Census Methods. ST/STAT/Series F/5 Rev. 1 in three volumes:

Vol.I—General Aspects of a Population Census. United Nations, New York, 1958. Price US $1.75

Vol. II—Economic Characteristics of the Population. United Nations, New York, 1958. Price US $0.80

Vol. III—Demographic and Social Characteristics of the Population. United Nations, New York.

* Methods of Estimating Population. ST/SOA/SER. A

Manual I—Methods of Estimating Total Population for Current Dates. Population Studies No. 10. United Nations, New York, 1952. Price US $0.50

Manual II—Methods of Appraisal of Quality of Basic Data for Population Estimates. Population Studies No. 23. United Nations, New York, 1956. Price US $0.70

Manual III—Methods for Population Projections by Sex and Age. Population Studies No. 25. United Nations, New York, 1956. Price US $0.80

WHO Expert Committee on Health Statistics, Report of the First Session. WHO Technical Report Series No. 5, Geneva, 1950. Price US $0.10

* WHO Expert Committee on Health Statistics, Report of the Second Session including reports on the first session of the Subcommittee on the Definition of Stillbirth and Abortion, on Registration of Cases of Cancer and on Hospital Statistics. WHO Technical Report Series No. 25, Geneva, 1950. Price US $0.25

* WHO Expert Committee on Health Statistics, Report on the Third Session, including second report of the Subcommittee on the Registration of Cases of Cancer as well as their Statistical Presentation. WHO Technical Report Series No. 53, Geneva, 1952. Price US $0.35

* First International Conference of National Committees on Vital and Health Statistics Report. WHO Technical Report Series No. 85, Geneva, 1954. Price US $0.25

WHO Expert Committee on Health Statistics, Report of the Fourth Session. WHO document WHO/HS/56, 11 November 1954, Geneva

* WHO Expert Committee on Health Statistics, Report of the Fifth Session. WHO Technical Report Series No. 133, Geneva, 1957. Price US $0.30

* WHO Expert Committee on Health Statistics, Sixth Report, including third report of the Subcommittee on Cancer Statistics. WHO Technical Report Series No. 164. Geneva 1959. Price US $0.30

Health Statistics, Bulletin of WHO, 1954, Vol. 11, Nos. 1-2, Geneva, Price US $3.00

WHO Report on the Study Group on Perinatal Mortality organized by the Regional Office for Europe of WHO in co-operation with the Government of Ireland and the Medical Research Council of Ireland, Dublin, November 1956. WHO document EUR/39-2/15, 11 March 1957

General Health Survey, Singur Health Centre, 1944, by R. B. Lal and S. C. Seal. Government of India Press, Calcutta, 1949.

United Nations Report on International Definition and Measurement of Standards and Levels of Living. United Nations Publication No. E/CN.3/179 and 5/299, March 1954, United Nations, New York. UN Sales No. 1954. IV. 5. Price US $0.80

WHO Study Group on the Measurement of Levels of Health, Report. WHO Technical Report Series No. 137, Geneva, 1957. Price US $0.30

Evaluation Schedule. American Public Health Association, New York. Price US $0.70

ILO Methods of Family Living Studies. International Labour Office, Geneva, 1949. Price US $0.40

People, Problems and Pieces of Paper. Tennessee Department of Public Health, Division of Vital Statistics, USA

Summary of Health and Vital Statistics: A compendium of highlights of statistics most commonly used for answering inquiries. US Department of Health, Education and Welfare, Public Health Service, Bureau of Statistical Services, National Office of Vital Statistics, April 1957

Foetal, Infant and Early Childhood Mortality, Vol. 1: "The Statistics"; Vol. 2 "Biological, Social and Economic Factors". Population Studies No. 13, (Series ST/SOA/Ser. A/13) United Nations, New York. Price US $1.50 and $0.40, respectively

* Control of Communicable Diseases in Man. Official Report of the American Public Health Association, New York, 8th edition, 1955. Price US $0.60

* Guide for the Reporting of Communicable Diseases in the Americas. PASB and WHO, Washington 6, D.C., USA. Miscellaneous Publications No. 6 (Rev. 1), 1955. Price US $0.60

1.3 **Periodical reports and journals**

1.3.1 *United Nations*

* United Nations Demographic Yearbook. Statistical Office of the United Nations, New York:

Year	Issue	Special topic	UN Sales No. & price (clothbound)	
1948	First	General Demography	1949.XIII.1	US $7.00
1949-50	Second	Natality Statistics	1951.XIII.1	US $6.00
1951	Third	Mortality Statistics	1952.XIII.1	US $6.00
1952	Fourth	Population Distribution	1953.XIII.1	US $7.50
1953	Fifth	General Demography	1953.XIII.9	US $6.50
1954	Sixth	Natality Statistics	1954.XIII.5	US $7.50
1955	Seventh	Population Censuses	1955.XIII.6	US $8.50
1956	Eighth	Ethnic and Economic Characteristics	1956.XIII.5	US $8.50
1957	Ninth	Mortality Statistics	1957.XIII.1	US $8.00
1958	Tenth	Marriage and Divorce Statistics	1958.XIII.1	US $8.00

Population Bulletin of the United Nations (provides information relating to population trends and problems as well as technical material for use in particular of governmental agencies, scientific institutions, and scholars engaged in social and economic research). Issued at irregular intervals. Price of each issue: No. 1, US $0.60. No. 2, $0.80; No. 3, $0.70; No. 4, $0.40

1.3.2 *World Health Organization*

* Annual Epidemiological and Vital Statistics, 1939-46.

Part I, Vital statistics and causes of death, WHO, Geneva, 1951

Part II, Cases of and deaths from notifiable diseases, WHO, Geneva, 1952. Price US $4.00 each Part

—ditto—1947-49

Part I, Vital statistics and causes of death, WHO, Geneva, 1952. Price US $10.00

Part II, Cases of and deaths from notifiable diseases, WHO, Geneva, 1953. Price US $3.75

—ditto—1950

Part I, Vital statistics and causes of death, WHO, Geneva, 1953. Price US $5.00

Part II, Cases of and deaths from notifiable diseases, WHO, Geneva, 1954. Price US $2.50

—ditto—1951 (in one volume only from 1951), Geneva, 1954. Price US $7.50

—ditto—1952, Geneva, 1955. Price US $10.00

—ditto—1953, Geneva, 1956. Price US $10.00

—ditto—1954, Geneva, 1957. Price US $10.00 (Including: vital statistics and causes of death; cases of and deaths from notifiable diseases; statistics of health personnel, hospital establishments and vaccinations)

—ditto—1955, Geneva, 1958. Price US $12.00 (including: vital statistics and causes of death; cases of and deaths from notifiable diseases; statistics of health personnel, hospital establishments and vaccinations)

* Epidemiological and Vital Statistics Report (Published monthly since June 1947, contains statistics on notifiable diseases, general mortality, infant mortality, natality, in

various countries and in larger towns). WHO, Geneva. Annual subscription: US $9.00

Weekly Epidemiological Record (contains notifications relating to quarantinable diseases as well as notes based on current statistical data on the incidence of certain non-quarantinable diseases whenever their prevalence becomes of international importance). WHO, Geneva. Annual subscription: US $14.00

Health statistics, by PAHO (Pan American Health Organization). Issued quarterly. Washington 6, D.C.

1.3.3 *USA*

Vital Statistics of the United States, Parts 1 and 2, published annually since 1936, previously published under the title of "Mortality Statistics" dating from 1923. National Office of Vital Statistics, Washington 25, D.C.

The Registrar (a co-operative official news bulletin) published monthly since 1936. National office of Vital Statistics, Washington 25, D.C.

Morbidity and Mortality Weekly Report (covering major cities) published since January 1952. Previously called "Weekly Health Index", published since January 1922, and "Weekly Mortality Index" since April 1941. National Office of Vital Statistics, Washington 25, D.C.

Vital Statistics Special Reports (Analytical Studies Series). First published in January 1936. National Office of Vital Statistics, Washington 25 D.C.

Motor Vehicle Accident Deaths, published weekly since September 1936

Statistical Bulletin of the Metropolitan Life Insurance Co., issued monthly. (Obtainable free from the Editor, Statistical Bulletin, Metropolitan Life Insurance Co., 1 Madison Avenue, New York, 10, N.Y.)

1.3.4 *United Kingdom and Commonwealth countries*

Report of the Registrar General for England and Wales, issued annually since 1839. "The Registrar General's Statistical Review of England and Wales".

Report of the Registrar General for Northern Ireland, issued annually since 1922.

Report of the Registrar General for Scotland, issued annually. Reports in Bureau Library since 1883, being the 29th report.

Report of the Chief Medical Officer of the Ministry of Health, England and Wales, on the State of the Public Health. Issued annually since 1919, formerly being a series presented by the Privy Council and the Local Government Board.

The Medical Officer, London, England. Issued weekly since 1908, Price 1s. 3d.

Demography, Official Statistics, Commonwealth of Australia, issued annually since 1906

Report of the Department of Public Health, Union of South Africa, issued annually since 1939. Report on Vital Statistics of the Union, 1926-38

Vital Statistics of the Dominion of New Zealand, issued annually since 1922. An amalgamation of reports entitled "Report of Statistics of New Zealand" and "Official Year Book", issued since 1890, embodying figures from 1881.

Studies on Medical and Population Subjects: A series of occasional publications designed to provide in convenient form a treatment of important subjects. General Register Office. Issued by H. M. Stationery Office, London

No. 1—Regional and local differences in cancer death rates, by Percy Stocks, 1947. Price 1s.

No. 2—Sickness in the population of England and Wales in 1944-1947, by Percy Stocks, 1949. Price 1s.

No. 3—Cancer registration in England and Wales, by Percy Stocks, 1950. Price 2s.

No. 4—Hospital morbidity statistics—A preliminary study of in-patient discharges, by Donald MacKay, 1951. Price 3s. 6d.

No. 5—Internal migration—Some aspects of population movement within England and Wales, by Mary P. Newton & James R. Jeffery, 1951. Price 1s. 6d.

Supplement to No. 3—Cancer registration in England and Wales—Third year recovery and survival rates, 1952. Price 1s. 3d.

No. 6—External migration—a study of the available statistics, 1815-1950, by N. H. Carrier, 1953. Price 8s 6d.

No. 7—General practitioners' records—An analysis of the clinical records of eight practices during the period April 1951 to March 1952, by W. P. D. Logan, 1953. Price 8s. 6d.

* No. 8—Measurement of morbidity—A report of the Statistics Subcommittee of the Registrar General's Advisory Committee on Medical Nomenclature and Statistics, 1954. Price 1s. 6d.

No. 9—(in continuation of Study No. 7)—General practitioners' records—An analysis

of the clinical records of some general practices during the period April 1952 to March 1954, Price 6s. 6d.

No. 10—Tuberculosis statistics for England and Wales 1938-1955—An analysis of trends and geographical distribution, by W. P. D. Logan and B. Benjamin. Price 4s. 6d.

No. 11—Internal migration—A study of the frequency of movement of migrants, by John A. Rowntree, 1957. Price 1s. 3d.

No. 12—The survey of sickness, 1943 to 1952, by W. P. D. Logan and Eileen M. Brooke, 1957. Price 4s.

No. 13—Cancer statistics for England and Wales, 1901-1955. A summary of data relating to mortality and morbidity, by A. McKenzie, 1957, Price 5s.6d.

No. 14—Morbidity statistics from general practice, Volume I (General) by W.P.D. Logan and A. A. Cushion, 1958. Price 15s.6d.

No. 15—Social and biological factors in infant mortality by J. A. Heady, 1959. Price £1.

Report on vital statistics of Canada, published annually since 1921

Vital Statistics—A reprint of an interpretative chapter published annually in the Canada Year Book. The reprints are available since the 1933-34 edition

Report of births, deaths and marriages registered in cities and towns, 10,000 population and over, published monthly since 1931

Population—Population census reports have been published by the Census Branch of the Dominion Bureau of Statistics since 1861

Contributory cause of death, first published in 1929—figures for 1926. Tabulated every five years since

1.4 **Publications depicting health statistics information by charts and diagrams**

Progress in health services, by the Health Information Foundation, 420 Lexington Avenue, New York 17, N.Y., (A series of interesting charts).

Health and demography, by H. L. Dunn. US Public Health Service, National Office of Vital Statistics, 1956.

Matters of life and death, foreword by G. North. General Register Office, H. M. Stationery Office, London, 1956. Price 1s.

Californian public health statistical report for 1955, State of California Department of Public Health, 2151 Berkeley Way, Berkeley, Calif.

Health practice indices 1947-1948. A collection of charts showing the range of accomplishments in various fields of community health service. American Public Health Association. Price US $1.00

Health atlas of India, published by the Directorate General of Health Services, New Delhi, 1953. Price US $0.80.

2. General reference

The American illustrated medical dictionary, by W. A. Newman Dorland. W. B. Saunders Co., Philadelphia and London, 1947. Price US $12.50

3. Statistical Considerations in Public Health Administration and Medical Care

Administrative medicine, edited by Haven Emerson. Thomas Nelson & Sons, 1951. The Williams and Wilkins Co., Baltimore, Md. Contains chapters on:

Vital statistics, by W. Thurber Fales, pp. 475-510

Sickness surveys, by Selwyn D. Collins, pp. 511-536

The evaluation of community health programs, by George T. Palmer, pp. 923-936

Rosenau: Preventive medicine and public health, by Kenneth F. Maxcy. Appleton-Century Crofts Inc., New York. 8th edition, 1956. Chapters 44 and 45 on 'Statistical reasoning' and 'Health of the population' by Paul M. Densen. Price US $15.00

Administration of health services, by W. G. Smillie and J. D. Porterfield. The Macmillan Co., New York, 1958. Price US $10.00

Backgrounds of social medicine, Milbank Memorial Fund, New York, 1949. Price US $1.00

Your community's health, by Dean F. Smiley and Adrian G. Gould, The Macmillan Co., New York, 1952. Price US $5.50

Principles of public health administration, by John J. Hanlon. The C. V. Mos byCo., St. Louis, 1955. Chapter 13 on Vital Statistics. Price US $8.50

4. Epidemiology

Global Epidemiology: A geography of diseases and sanitation, by J. S. Simmons *et al.* 3 vol, Published by J. P. Lippincott Co., Philadelphia, 1944.

Vol 1, Part 1: India and the Far East
Part 2: The Pacific Area
Vol 2, Africa and the Adjacent Islands
Vol 3, The Near and Middle East
Price: Vol. 1, US $10.00; Vol. 2, $15.00; Vol. 3, $12.00

Uses of epidemiology, by J. N. Morris. E. & S. Livingstone, Ltd Edinburgh and London, 1957. Price 17s. 6d.

Principles of epidemiology, by I. Taylor & J. Knowelden. J. & A. Churchill Ltd., London, 1957. Price 30s.

The mathematical theory of epidemics, by N. T. Bailey. C. Griffin & Co. Ltd., London, 1957. Price 36s.

Papers of Wade Hampton Frost, edited by K. F. Maxcy. The Commonwealth Fund, New York, 1941. Price US $3.00

Welt-Seuchen-Atlas (World Atlas of Epidemic Diseases) by E. Rodenwaldt *et al.* Part I, Part II, Part III (in preparation), Hamburg, Falk-Verlag, 1952

Atlas of distribution of diseases, by the American Geographical Society of New York, New York, 1950. (Each plate is published separately, the 17th published in 1955)

Epidemics and crowd diseases, by M. Greenwood. Williams and Norgate, 1935.

Experimental epidemiology, by M. Greenwood, A. Bradford Hill, W. W. C. Topley & J. Wilson. Medical Research Council Special Reports Series No. 209, H. M. Stationery Office, London, 1936. Price 3s. 6d.

Chronic illness in the United States: Vol. III, Chronic Illness in a Rural Area; Vol. IV, Chronic illness in a large city—The Baltimore Study. Commission on Chronic Illness, The Commonwealth Fund, Harvard University Press, Cambridge, Mass., 1957. Price Vol. IV US $8.00

5. Biostatistics

* Principles of medical statistics, by A. Bradford Hill. The Lancet, London, 1955. Price 10s. 6d.

Statistics for medical and other biological students, by L. Bernstein and M. Weatherall. E. & S. Livingstone Ltd., Edinburgh and London, 1952. Price 18s.

Elementary medical statistics; the principles of quantitative medicine, by D. Mainland. W. B. Saunders Co., Philadelphia, 1952. Price US $5.00

Elementary statistics with applications in medicine, by F. E. Croxton. Prentice-Hall Inc., New York, 1953. Price US $6.95

An introduction to applied biometrics, by L. P. V. Johnson, Burgess Publishing Co., Minneapolis, 1950. Price US $3.00

Biometric analysis, by A. E. Treloar. Burgess Publishing Co., Minneapolis, 1951. Price US $4.50

Statistics of therapeutic trials, by G. Herdan. Elsevier Publishing Co., Amsterdam, Houston, London, New York, 1955. Price 50s.

Statistical analysis in biology, by K. Mather. Methuen & Co., London, 1946. Price 16s.

Advanced statistical methods in biometric research, by C. R. Rao. John Wiley and Sons Inc., New York, 1952. Price US $10.00

Mathematics and statistics for use in pharmacology, biology and chemistry, by L. Saunders & R. Fleming. The Pharmaceutical Press, London, 1957. Price 27s. 6d.

Introduction to biostatistics, by Huldah Bancroft. Paul B. Hoeber Inc., Medical Book Dept. of Harper & Bros., New York, 1957. Price US $5.75

6. General Statistical Methods

Elementary statistical methods, by Helen M. Walker, Henry Holt & Co., New York, 1943. Price $2.75

Modern elementary statistics, by John E. Freund. Prentice-Hall Inc. New York, 1952. Price US $7.00

* Statistical methods for research workers, by Ronald A. Fisher. Oliver & Boyd, Edinburgh, 12th edition, 1954. Price 16s.

An introduction to the theory of statistics, by G. Udny Yule & M. G. Kendall. Charles Griffin & Co. Ltd., London, 14th edition, 1950. Price 34s.

Statistics, by L. H. C. Tippett. The Home University Library, Oxford University Press, London, 1956. Price 7s. 6d.

The methods of statistics, by L. H. C. Tippett. Williams & Norgate, London, 1952. Price 17s. 6d.

Introduction to the theory of statistics, by Alexander McFarlane Mood. McGraw Hill Book Co., New York, 1950. Price US $6.50: Answers, price US $0.50

Elements of statistics, by Elmer B. Mode. Prentice-Hall Inc., New York, 2nd edition, 1951. Price US $5.25

Dictionary of statistical terms, by Maurice G. Kendall & William R. Buckland. Oliver & Boyd, Edinburgh, 1957. Price 25s.

Introduction to statistical analysis, by W. J. Dixon & F. J. Massey. McGraw Hill Book Co., New York, 2nd edition, 1957. Price US $6.00

Statistical methods applied to experiments in agriculture and biology, by G. W. Snedecor. Iowa State College Press, Ames, Iowa, 5th edition, 1956. Price US $7.50

Applied general statistics, by Frederick E. Croxton & Dudley J. Cowden. Prentice Hall Inc., New York, 1955. Price US $9.00

Statistical theory in research, by R. L. Anderson & T. A. Bancroft. McGraw Hill Book Co., New York, 1952. Price US $7.00

First course in probability and statistics, by J. Neyman. Holt, New York, 1950. Price US $3.50

Advanced theory of statistics, by Maurice G. Kendall. Charles Griffin & Co. Ltd., London. Vol. I, 1958, Price 84s. Vol. II, 1951, price 72s.

Elementary statistical analysis, by S. S. Wilks. Princeton University Press, Princeton, 1948. Price US $2.50

Statistics: a new approach, by W. Allen Wallis & Harry V. Roberts. The Free Press Glencoe, Ill., 1956. Price US $6.00

How to lie with statistics, by Darrell Huff. W. W. Norton Co. Inc., New York, 1954. Price US $2.95

Facts from figures, by M. J. Moroney. Penguin Book Co., London 1956. Price 5s.

Statistics for sociologists, by Margaret J. Hagood and D. O. Price. New York, rev. ed. 1952. Price US $7.75

Introduction to mathematical statistics, by Paul G. Hoel. John Wiley & Sons Inc., New York, 2nd edition, 1954. Price US $5.00

The place of statistical methods in biological and chemical experimentation, by E. J. de Beer. Annals of the New York Academy of Sciences, Vol. 52, 1950

Rank correlation methods, by M. G. Kendall. Charles Griffin & Co. Ltd., London, 1948. Price 18s.

6.1 **Special statistical fields**

6.1.1 *Tabulations*

* Manual of tabular presentation, by Bruce L. Jenkinson. Bureau of the Census, US Department of Commerce, Government Printing Office, Washington D.C. 1949. Price US. $1.50

Tabulation of health department services: Reports of the Committee on Records and Reports to State and Territorial Health Officers and the US Public Health Service in the 34th Annual Conference, Washington D.C., 13 April 1936. Public Health Reports, 51, pp. 1236-1246

6.1.2 *Punch cards and data processing*

Punch card methods, by H. P. Hartkemeier. W. C. Brown, Dubuque, Iowa, 1952. Price US $5.00

Punch cards: their application to science and industry, by Robert S. Casey & James W. Perry. Book Division, J. Reinhold, New York, 1951. Price US $10.00

Creating the punched card by the Organisation and Methods Division. H. M. Treasury, London 1953.

Manual for medical record librarians, by Edna K. Huffman. Physicians Record Company, Chicago 1955. Price US $9.75

Studies in data processing methods, by Food and Agriculture Organization and United Nations Statistical Office, 1959.

1. Scope and principal methods of data processing
2. Planning, organizing and administering data processing services
3. The elements of planning a punch card installation
4. Manual methods and tools for data processing
5. Punch-card sorting

6.1.3 *Charts and diagrams* (see also item 10)

How to chart facts from figures with graphs, by Walter E. Weld. Codex Book Co. Ltd., Norwood, Mass., 1950. Price US $3.00

Graphs: how to make and use them, by H. Arkin & R. R. Colton. Harper, New York, 3rd edition, 1940. Price US $3.00

Charting statistics, by Mary E. Spear. McGraw Hill Book Co., New York, 1952. Price US $4.50

Handbook of graphic presentation, by Calvin F. Schmid. The Ronald Press Co., New York, 1957. Price US $6.00

Engineering and scientific graphs for publication, American Standard Association, American Society of Mechanical Engineers, New York, 1947. Price US $0.30

6.1.4 *Statistical computations*

Statistical calculation for beginners, by E. G. Chambers. Cambridge University Press, 1945. Price 15s.

6.1.5 *Design of experiments*

Elementary design and its statistical basis, by D. J. Finney. The University of Chicago Press, 1955. Price US $4.50

Design of experiments, by Ronald A. Fisher. Oliver & Boyd, Edinburgh, 1951. Price 12s. 6d.

Experimental designs, by William G. Cochran & Gertrude M. Cox. John Wiley & Sons Inc., New York, 2nd edition, 1957. Price US $10.25

The design and analysis of experiments, by M. H. Quenouille. Charles Griffin & Co., London, 1956. Price 42s.

Experimental design: theory and application, by Walter T. Federer. The Macmillan Co., New York 1955. Price US $11.00

Statistical methods in experimentation: an introduction, by Oliver L. Lacey. The Macmillan Co., New York, 1953. Price US $4.50

6.1.6 *Sampling and surveys*

Scientific social surveys and research: an introduction to the background, content, methods and analysis of social studies, by Pauline V. Young & Calvin F. Schmid. Prentice Hall Inc., New York, 1954. Price US $6.50

* The preparation of sampling survey reports, Statistical Papers, Series G, No. 1 (revised), Statistical Office of the United Nations, New York, 1950

* Sampling methods for censuses and surveys, by F. Yates. Charles Griffin & Co. Ltd., London, 2nd edition, 1954. Price 38s.

Recent experiments in statistical sampling in the Indian Statistical Institute, by P. C. Mahalanobis. Sankhya. Vol. 20. pp 329-397, 1958.

Some theory of sampling, by W. E. Deming. John Wiley & Sons Inc., New York, 1950. Price US $10.00

Sampling theory of surveys with applications, by P. V. Sukhatme. The Iowa State College Press, Ames, Iowa, 1953. Price US $6.00

Sampling survey methods and theory, by M. H. Hansen, W. N. Hurwitz & W. G. Madow, Vols. 1 and 2. John Wiley & Sons Inc., New York 1953. Price: Vol. 1, US $8.75; Vol. 2 $7.75

Survey methods in social investigations, by C. A. Moser. Wm. Heinneman Ltd. London, 1958, Price 35s.

The Statistical design of the health household-interview survey, US Public Health Service publication No. 584—A2, US National Health Survey, 1958, Washington D.C., 1958. Price US $0.35

Sampling techniques, by W. G. Cochran. John Wiley & Sons, Inc., New York, 1953. Price US $7.00

The art of asking questions, by S. L. Payne. Princeton University Press, rev. ed. 1955. Price US $4.00

Surveys, polls and samples, by M. Parten. Harper & Bros., 1950. Price US $7.50

6.1.7 *Record cards*

Recording of local health work, by W. F. Walker & C. R. Randolph. The Commonwealth Fund, New York, 1936.

Records and reports of local health departments: criteria and methods for organization, maintenance and use, by Olive G. Johnson. US Public Health Monograph No. 15, US Government Printing Office, Washington D.C. 1953. Price US $0.25

A manual for record keeping and statistical reporting for mental health clinics, US Public Health Service Publication No. 539, 1957. Price US $0.45

6.1.8 *Biological standardization*

Statistical method in biological assay, by D. J. Finney. Charles Griffin & Co. Ltd., London, 1952. Price 78s.

Probit analysis, by D. J. Finney. Cambridge University Press, London, 2nd edition, 1952. Price 35s.

6.1.9 *Quality control*

Statistical quality control, by E. L. Grant. McGraw Hill Book Co., New York, 1946. Price US $5.00

Economic control of quality of manufactured products, by W. A. Shewhart. D. Van Nostrand Co. Inc., New York, 1931. Price US $8.25

6.2 **Special health fields**

6.2.1 *Occupational mortality*

Registrar General for England and Wales: Decennial supplement: Occupational mortality, Parts I and II, 1958. Price £7.7.0

Statistical and epidemiological methods in occupational medicine, by D. D. Reid, in Industrial medicine and hygiene, edited by E. R. A. Merewether, Vol. I, Butterworth & Co., London, 1954.

6.2.2 *Nutrition*

Statistics for workers in nutrition and allied fields, by S. Swaroop. Memoir No. 36, Indian Council of Medical Research, 1950, published by Job Press, Cawnpore, Price Rs. 6.50

6.2.3 *Malaria*

The epidemiology and control of malaria, by George Macdonald. Oxford University Press, London, 1957. Price 30s.

Statistical methodology in malaria work, by S. Swaroop. World Health Organization, Geneva, WHO/Mal/174 Rev. 1, 1958

6.2.4 *Genetics*

An introduction to genetic statistics: an integrated account of statistical problems and procedures in genetics, by Oscar Kempthorne. John Wiley & Sons Inc., New York, 1957. Price US $12.75

6.2.5 *Biology and chemical experimentation*

The place of statistical methods in biological and chemical experimentation. Annals of the New York Academy of Sciences, Vol. 52, 1950

6.2.6 *General medicine*

Measurement in medicine, British Medical Bulletin, Part I, Vol, 7, No. 4, 1951

6.2.7 *Bacteriology, etc.*

Statistical methods and control in bacteriology, by Churchill Eisenhart and P. W. Wilson. Bacteriological Reviews, Vol. 7, No. 2, June 1943

Statistical concepts in microbiology, by R. L. Stearman. Bacteriological Reviews, Vol. 19, No. 3, September 1955

7. Mathematics for health statistics

Mathematics essential for elementary statistics. A self-teaching manual: by Helen M. Walker. Henry Holt & Co., New York, rev. ed. 1951. Price US $4.25

Biomathematics, by C. A. B. Smith. Charles Griffin & Co. Ltd., London, 1954. Price 80s.

A first course in mathematical statistics, by C. E. Weatherburn. Cambridge University Press, London, 1952. Price 15s.

Higher mathematics for students of chemistry and physics, by J. W. Mellor, 1912. Dover Publications Inc., New York. Price US $3.95

Mathematics of statistics, by J. F. Kenney & E. S. Keeping, Part I, 3rd edition, 1954; Part II, 2nd edition, 1951. Van Nostrand. New York. Price, Part I, US $5.00; Part II, $5.50

Elements of physical biology, by A. J. Lotka. Dover Publications, New York, 1957. Price US $2.45

Mathematical methods for statistics, by H. Cramer. Princeton University Press, Princeton, 1946. Price US $6.00

Fundamental mathematics, by Kenneth O. May. Addison-Wesley Publishing Co. Inc., Cambridge Mass., 1955

8. Ready Reference Tables

* Barlow's tables, squares, cubes, square roots and reciprocals, by E. & F. N. Spon Ltd., London, 1941. Price 16s.

* Chambers' logarithmic tables, edited by James Pryde. Chambers Ltd., London, 1951. Price 5s.

Biometrika tables for statisticians, Vol., 1 edited by E. S. Pearson & H. O. Hartley. Cambridge University Press, London, 1954. Price 25s.

* Statistical tables for biological, agricultural and medical research, by R. A. Fisher & F. Yates. Oliver & Boyd, Edinburgh, 5th edition, 1957. Price 24s.

Tables for use with binomial samples, by D. Mainland, L. Herrera & M. I. Sutcliffe.
Department of Medical Statistics, New York University College of Medicine, 1956. Price US $2.50

Cambridge elementary statistical tables, by D. V. Lindley & J. C. P. Miller. Cambridge University Press, London, 1953. Price US $1.00

9. SELECTED LISTS OF PUBLICATIONS CONTAINING REFERENCES ON VITAL AND HEALTH STATISTICS

Useful catalogues of League of Nations, World Health Organization and United Nations publications

League of Nations

Bibliography of the technical work of the Health Organisation of the League of Nations 1920-1945, Bulletin of Health, Vol. XI, Geneva 1945

World Health Organization

World Health Organization publications 1947-1956, Geneva; and subsequent issues

United Nations

Ten years of United Nations publications, 1945-1955: a complete catalogue, UN Department of Public Information, Sales & Circulation Section, 1955. UN Sales No. 1955.I.8, price US $0.50

United Nations Publications 1955, and subsequent volumes published annually in the series ST/DPI/SER F./8,9, . . .

United Nations Periodical Statistical Publications

Monthly bulletin of statistics. Price US $1.00 per copy; annual subscription $10.00

Statistical Yearbook. Price, paperbound about US $6.00; clothbound about $7.50

Yearbook of International Trade Statistics. Price US $4.50 (paperbound)

Commodity Trade Statistics (quarterly). Statistical Papers, Series D. Price US $1.00 per copy; annual subscription $4.00

Direction of International Trade. Statistical Papers, Series T. One annual issue and eleven monthly issues. Price US $0.50 per copy; annual subscription $5.00

Statistics of National Income and Expenditure (semi-annual). Statistical Papers, Series H. Price US $0.80 per copy (approx.)

Demographic Yearbook. Price, paperbound about US $6.50; clothbound about $8.00

Population and Vital Statistics Report (quarterly). Statistical Papers, Series A. Price US $0.30 per copy (approx.)

United Nations Statistical Papers, Series M (obtainable from the Statistical Office, United Nations, New York)

M.2 Report on the first Latin American Training Centre on Statistics and Censuses, Mexico D.F., 1948

M.4 International Standard Industrial Classification of all Economic Activities, 1949

M.5 Report on the European Centre of Applied Agricultural and Demographic Statistics, Paris, 1949

M.6 Report on the International Training Centre on Statistics and Censuses for the Near East Countries, Cairo, Egypt, 1949

M.7 Report on the International Training Centre on Censuses and Statistics for South-East Asia and Oceania, New Delhi and Calcutta, India, November 1949—February 1950

M.8 International Standard Definitions for Transport Statistics, 1950

M.9 Report on the Inter-American Seminar for Biostatistics, Santiago, Chile, 1950

M.10 Commodity Indexes for the Standard International Trade Classification, 1951. Price US $5.00

M.11 List of Statistical Series Collected by International Organizations, 1951. Price US $0.80

M.12 Report on the International Training Centre on Vital Statistics and Health Statistics for South-East Asia, Ceylon, 1951

M.13 Report on the Training Centre on Vital Statistics and Health Statistics for the Eastern Mediterranean, Cairo, Egypt, 1951

M.14 Retail Price Comparisons for International Salary Determination, 1952. Price US $0.40

M.15 Report on the Western Pacific Regional Seminar on Vital Statistics and Health Statistics, Tokyo, Japan, 1952

M.16 Report and Proceedings of the United Nations International Seminar on Statistical Organization, Ottawa, Canada, 1952. Price US $1.50

M.17 International Standards in Basic Industrial Statistics, 1953. Price US $0.30

M.18 Bibliography of Recent Official Demographic Statistics, 1953. Price US $0.80

* M.19 Principles for a Vital Statistics System, 1953. Price US $ 0.30

M.20 International Migration Statistics, 1953. Price US $0.25

M.21 World Weights and Measures (Preliminary Issue), 1955. Price US $2.00

M.22 Directory of International Standards for Statistics, 1955. Price US $0.20

M.23 Final Report of the First Inter-American Seminar on Civil Registration, Santiago, Chile, 1954. Price US $0.30

M.24 Report on the Training Centre on Vital and Health Statistics, Kabul, Afghanistan, 1954. Price US $0.20

M.25 Final Report of Inter-American Centre of Biostatistics, Santiago, Chile, 1952-55, 1957. Price $0.70

M.26 International Recommendations in Statistics of Distribution, 1958. Price $0.20

M.27 Principles and Recommendations for National Population Censuses, 1958. Price US $0.30

M.28 General Principles for a Housing Census, 1958. Price US $0.20

United Nations Studies in Methods, Series F

F.1 Index Numbers of Industrial Production, 1950. Price US $0.25

F.2 A System of National Accounts and Supporting Tables, 1952. Price US $0.50

F.3 Concepts and Definitions of Capital Formation, 1953. Price US $0.25

F.4 Industrial Censuses and Related Enquiries, 2 vols. 1953. Price US $5.00 (complete); $2.50 (single vol.)

F.5 (Rev. 1) Handbook of Population Census Methods, in three volumes (see section 1.2 of this Appendix).

F.6 Handbook of Statistical Organization, 1954. Price US $1.50

F.7 Handbook of Vital Statistics Methods, 1955. Price US $2.50

F.8 Methods of National Income Estimation, 1955. Price US $0.50

10. Addresses of some firms dealing in calculating machines. Punch-card equipment, catalogues, materials for graphs and visual aids, etc.

10.1 Calculating machines

Calculating machines are classified into two broad categories—rotary calculating machines and key-actuated calculating machines.

Rotary calculating machines may be fully automatic, semi-automatic or hand-operated.

Key-actuated machines may be key driven or motor-driven.

The primary use of key-actuated calculating machines is in the addition of amounts from source documents and in the addition and balancing of tabulated data. But these machines can be used for calculations involving multiplication and division.

Firms in various countries are producing calculating machines in different capacities, either hand-operated or fully or semi-automatic. New models are brought out from time to time. Details of the latest models available may be obtained from some addresses given below. One machine that is fully automatic for undertaking addition, subtraction, multiplication and division and at the same time providing a printed record of results and desirable operations, is produced by OLIVETTI of Italy, and is called 'TETRACTYS', Ing. C. Olivetti & C. S.p.a., Via G. Jervis 11/13, Ivrea, Italy.

10.1.1 *Rotary calculating machines*

Brunsviga	Brunsviger Maschinenwerke A.G., Braunschweig, Germany
Curta	Contina A.G., Vaduz, Liechtenstein. (A pocket-size machine)
Facit	Aktiebolaget Atvidabergs Industrier, Stockholm 7, Sweden
Friden	Friden Calculating Machine Co. Inc., San Leandro, Calif., USA
Madas	H. W. Egli, S.A., 356/58 Seestrasse, Zürich 2/38, Switzerland
Marchant	Marchant Calculating Machine Co., Oakland 8, Calif., USA
Monroe	Monroe Calculating Machine Company, Orange, New Jersey, USA Monroe Calculating Machine Company Holland, N.V., Pilotenstraat 6, Amsterdam-W., Holland
Odhner	Aktiebolaget Original Odhner, Göteborg, Sweden

10.1.2 *Key-actuated calculating machines*

BURROUGHS Burroughs Adding Machine Company, Detroit and Plymouth, Michigan, USA; Windsor, Ontario, Canada; Nottingham, England
CALCULATOR
COMPTOMETER Felt & Tarrant Mfg Co., 1735 N. Paulina Street, Chicago 22, Illinois, USA
SUMLOCK Bell Punch Company Ltd., 39 St. James's Street, London, S.W.1

10.1.3 *Adding machines*

ADDO Aktiebolaget Addo, Malmö, Sweden
BRUNSVIGA Brunsviger Maschinenwerke A.G., Braunschweig, Germany
FACTA Aktiebolaget Atvidabergs Industrier, Stockholm 7, Sweden
NATIONAL The National Cash Register Co., Dayton 9, Ohio, USA
OLIVETTI Ing. C. Olivetti & C. S.p.a., Via G. Jervis 11/13, Ivrea, Italy
REMINGTON Remington Rand, 315 Fourth Avenue, New York 10, USA
WALTHER Walther Büromaschinen K.C., Niederstotzingen, Württemberg, Germany

10.2 **Peg-board accounting**

Comptometer Division, Felt & Tarrant Mfg Co., 1735 N. Paulina Street, Chicago 22, Illinois, USA

10.3 **Punching, sorting and tabulating machines**

IBM International Business Machines Corporation, World Headquarters Building, 590 Madison Ave., New York 22, N.Y. USA
REMINGTON Remington Rand Inc., 315 Fourth Avenue, New York 10, N.Y., USA
ICT International Computers and Tabulators Ltd. (Formerly: Powers Samas and British Tabulating Co.), 149 Park Lane, London, W.1
BULL Compagnie des Machines BULL, 94 Avenue Gambetta, Paris

10.4 **Needle sorting systems**

10.4.1 Punch cards (marginal):

PARAMOUNT Copeland Chatterson Co. Ltd., Gateway House, Watling Street, London, E.C.4
EKAHA Edler & Krische, Kestnerstrasse, 42, Hannover, Germany
McBEE or KEYSORT Royal McBee Corporation, 2 Park Avenue, New York, N.Y.
C.F.M. Compagnie des Fichiers Modernes, 78 rue de Wattignies, Paris, 12e

10.4.2 Punched card (field):

FINDEX System: C. W. Cave & Co. Ltd., 59 Holborn Viaduct, London, E.C.1
SORTEX System: Sortex A.G., Nüschelerstrasse 31, Zürich, Switzerland

10.5 **Graphic material**

Graphic sheets of almost all kinds, sizes and designs needed in statistical work have been designed by:

Codex Book Co. Inc., Norwood, Mass., USA. A detailed catalogue is available on request.

Keuffel & Esser Co., 127 Fulton Street, New York, N.Y., USA. Slide rules, various kinds of chart and graph paper.

Draftsman's mathematical instrument box (compass, ruling pen, set squares, protractor, etc.) available in any stationery shop.

Para-Tone Co. Inc., 343 S. Dearborn Street, Chicago, Ill., USA. Zip-a-tone screens for mechanical shading.

Gunther Wagner, Hannover, Germany. Graphos pen with nibs of various sizes.

A. West & Partners Ltd., 36 Broadway, Westminster, London, S.W.1. Catalogue details lettering stencils of various sizes, etc.

Pictorial Statistics Inc., 142 Lexington Avenue, New York, N.Y., USA. Various kinds of pictorial charts, maps and ready-made symbols.

APPENDIX II

STATISTICAL POINTS DISCUSSED IN REPORTS OF WHO EXPERT COMMITTEES AND STUDY GROUPS

WHO Technical Report Series	Subject	Title of the report	Special statistical points discussed
5	Health statistics	Expert Committee on Health Statistics: Report on the First Session, March 1950	Establishment of National Committees on Health Statistics; medical certification and classification of causes of death, epidemiological statistical publications; health statistics in under-developed areas; teaching of health statistics and training of personnel in health statistics; statistical appraisal of researches and experience made under WHO programmes.
7	Tuberculosis	Expert Committee on Tuberculosis: Report on the Fourth Session 1950	Classification of pulmonary tuberculosis.
8	Malaria	Expert Committee on Malaria: Report on the Third Session 1950	Basic principles in field and hospital trials on antimalarials.
9	Mental health	Expert Committee on Mental Health: Report on the First Session, 1950	Interpretation of statistical information on mental health.
15	Venereal disease	Venereal-Disease Control in the USA: Report of the WHO Syphilis Study Commission, 1950	Morbidity reporting, case-finding and case-holding of syphilis in the USA.
19	Yellow fever	Yellow-Fever Panel: Report on the First Session, 1950	Criteria for determination of yellow-fever "endemic" areas; definition of the *A. aegypti* index; definition of yellow-fever areas.
23	Rickettsioses	Joint OIHP/WHO Study Group on African Rickettsioses: Report on the First Session, 1950	Classification and nomenclature of the human rickettsioses in Africa.
25	Health statistics	Expert Committee on Health Statistics: Report on the Second Session, 1950	Definition of stillbirth and abortion; registration of cases of cancer and their statistical presentation; hospital statistics.

WHO Technical Report Series	Subject	Title of the report	Special statistical points discussed
27	Prematurity	Expert Group on Prematurity: Final Report, 1950	Definition of prematurity.
28	Rabies	Expert Committee on Rabies: Report on the First Session, 1950	Collection and evaluation of rabies statistics.
30	School health	Expert Committee on School Health Services: Report on the First Session, 1951	School health records.
31	Mental health	Expert Committee on Mental Health: Report on the Second Session, 1951	Mental health statistics and epidemiological studies.
32	Tuberculosis	Expert Committee on Tuberculosis: Report on the Fifth Session, 1951	Notification of tuberculosis.
33	Venereal infection	Expert Committee on Venereal Infections and Treponematoses: Report on the Second Session of the Sub-committee on Serology and Laboratory Aspects, 1951	Mass serological examinations.
38	Malaria	Report on the Malaria Conference in Equatorial Africa, 1951	Malaria mortality and morbidity in Africa; classification of various degrees of malaria endemicity; types of information to be collected in malaria control.
41	Sanitary Regulations	International Sanitary Regulations: World Health Organization Regulations No. 2, 1951	Definitions; notifications and epidemiological information.
42	Mental health	Expert Committee on Mental Health: Report on the First Session of the Alcoholism Sub-committee, 1951	Development of national statistics on the incidence of alcoholism.
44	Nutrition	Joint FAO/WHO Expert Committee on Nutrition: Report on the Second Session, 1951	Survey for the assessment of nutritional status; types of data to be collected.
48	Mental health	Expert Committee on Mental Health, Alcoholism Sub-committee: Second Report 1952	Surveys and statistics on alcoholism; classification of alcoholics and other excessive drinkers.

WHO Technical Report Series	Subject	Title of the report	Special statistical points discussed
52	Cholera	Expert Committee on Cholera: First Report, 1952	Statistical studies on cholera endemicity.
53	Health statistics	Experts Committee on Health Statistics: Third Report, 1952	Morbidity statistics; registration of cases of cancer and their statistical presentation; International Statistical Classification of Diseases, Injuries, and Causes of Death, etc.
59	Trachoma	Expert Committee on Trachoma; First Report, 1952	Classification of trachoma.
62	Hepatitis	Expert Committee on Hepatitis: First Report, 1953	Notification of hepatitis.
63	Venereal infection	Expert Committee on Venereal Infections and Treponematoses: Fourth Report, 1953	Epidemiological considerations in mass treatment control programmes of treponematoses.
64	Influenza	Expert Committee on Influenza: First Report, 1953	Collection and distribution of epidemiological information regarding influenza.
65	Bilharziasis	Expert Committee on Bilharziasis; First Report, 1953	Standard procedures for epidemiological surveys of bilharziasis.
66	Occupational health	Joint ILO/WHO Committee on Occupational Health: Second Report, 1953	Notification of occupational diseases.
71	Leprosy	Expert Committee on Leprosy: First Report, 1953	Classification of leprosy cases.
72	Nutrition	Joint FAO/WHO Expert Committee on Nutrition: Third Report, 1953	Suggestions for further field research on malnutrition.
73	Mental health	Expert Committee on Mental Health: Third Report, 1953	Prevalence of psychiatric disorders.
74	Plague	Expert Committee on Plague: Second Report, 1953	Wild-rodent surveys.
75	Mental health	The Mentally Sub-normal Child:	Classification and terminology: prevalence of subnormality.

WHO Technical Report Series	Subject	Title of the report	Special statistical points discussed
		Report of a Joint Expert Committee convened by WHO with the participation of the United Nations, ILO and UNESCO, 1954	
78	Rheumatic diseases	Expert Committee on Rheumatic Diseases: First Report, 1954	Classification of rheumatic diseases; collection of statistical data on incidence and prevalence of rheumatic diseases.
80	Malaria	Expert Committee on Malaria: Fifth Report, 1954	Appraisal of results of malaria control.
83	Health programme for rural areas	Methodology of Planning an Integrated Health Programme for Rural Areas: Second Report of the Expert Committee on Public Health Administration, 1954	Maintenance of records for statistical purposes.
84	Alcohol	Expert Committee on Alcohol: First Report, 1954	Statistical studies regarding alcohol and road accidents.
85	National Committees on Vital and Health Statistics	First International Conference of National Committees on Vital and Health Statistics: Report, 1954	National committees on vital and health statistics; health statistics and related vital statistics required by countries and territories according to the degree of development of the health and administrative services; methods of improving the quality of health statistics; implementation of international regulations or recommendations.
87	Onchocerciasis	Expert Committee on Onchocerciasis, First Report, 1954	Proposed standardization of epidemiological surveys on onchocerciasis.
90	Bilharziasis	Bilharzia Snail Vector Identification and Classification (Equatorial and South Africa): Report of a Study Group, 1954	Classification of snails; particulars required concerning snail collections.
94	Alcohol and alcoholism	Alcohol and alcoholism: Report of an Expert Committee, 1955	Classification of disorders induced by alcohol.

WHO Technical Report Series	Subject	Title of the report	Special statistical points discussed
97	Nutrition	Joint FAO/WHO Expert Committee on Nutrition: Fourth Report, 1955	Anthropometry applied to nutrition; assessment of nutritional status.
100	Amputees and prostheses	Amputees and Prostheses: Report of a Conference on Prostheses, 1955	Statistics on amputees.
101	Poliomyelitis	Poliomyelitis Vaccination: A Preliminary Review, 1956	Design and techniques of serological surveys.
106	Trachoma	Expert Committee on Trachoma: Second Report, 1956	Epidemiological investigations of trachoma and its associated infections; the planning of antitrachoma project; appraisal of control projects.
112	Tuberculosis	Tuberculosis Control: Plans for Intensified Inter-Country Action in Europe: Report of a Study Group, 1956	Planning for inter-country comparability of statistical data.
114	Pesticides	Toxic Hazards of Pesticides to Man: Report of a Study Group, 1956	Reporting of cases of pesticide poisoning.
115	Maternal and child health	Administration of Maternal and Child Health Services: Second Report of the Expert Committee on Maternal and Child Health, 1957	Vital statistics in evaluation of MCH programmes.
117	Atherosclerosis and ischaemic heart disease	Study Group on Atherosclerosis and Ischaemic Heart Disease: Report, 1957	Pilot surveys on atherosclerosis and ischaemic heart disease; availability of vital statistics and epidemiological information; recommendations for collection of vital statistics, insurance company statistics and epidemiological studies of the disease.
118	Accidents	Accidents in Childhood, Facts as a Basis for Prevention: Report of an Advisory Group, 1957	Epidemiology of accidents; information on mortality and morbidity; design of statistical studies as a basis for preventive work and for its subsequent evaluation.
120	Bilharziasis	Study Group on the Ecology of Intermediate Snail Hosts of Bilharziasis: Report, 1957	Quantitative methods for the measurement of the density of mollusc populations.

WHO Technical Report Series	Subject	Title of the report	Special statistical points discussed
123	Malaria	Expert Committee on Malaria: Sixth Report, 1957	Survey techniques and surveillance processes of malaria situations.
126	Rheumatic fever	Prevention of Rheumatic Fever: Second Report of the Expert Committee on Rheumatic Diseases, 1957	Morbidity and mortality statistics on rheumatic fever.
130	Epilepsy	Juvenile Epilepsy: Report of a Study Group, 1957	Prevalence of juvenile epilepsy.
132	Malaria	Malaria Conference for the Eastern Mediterranean and European Regions; Report, 1957	Need for a malaria surveillance organization; recording of malaria statistics.
133	Health statistics	Expert Committee on Health Statistics: Fifth Report, 1957	Morbidity statistics; national committees on vital and health statistics; collection of health statistics in under-developed areas, training of statistical workers, role of WHO; hospital morbidity statistics; health indicators as measures of health, including demographic conditions.
137	Levels of health	Measurement of Levels of Health: Report of a Study Group, 1957	Possible indicators of health.
139	Bilharziasis	African Conference on Bilharziasis: Report, 1957	Present distribution of bilharziasis and of existing intermediate hosts in African territories south of the Sahara; needed morbidity and mortality statistics on bilharzia; methods employed in epidemiological surveys of human populations; factors influencing the epidemiology of bilharziasis.
143	Athero-sclerosis	Classification of Atherosclerotic Lesions: Report of a Study Group, 1958	Classification and grading of atherosclerotic lesions.
145	Poliomyelitis	Expert Committee on Poliomyelitis, Second Report, 1958	Serological surveys, sampling procedures.
149	Nutrition	Joint FAO/WHO Expert Committee on Nutrition: Fifth Report, 1958	Criteria for assessing the state of nutrition and food consumption of population groups.

WHO Technical Report Series	Subject	Title of the report	Special statistical points discussed
152	Mental health	Ataractic and Hallucinogenic Drugs in Psychiatry, Report of a Study Group, 1958	Sources of error, the placebo response; the calibration of linguistic tools; selection of observers and requirements of trial design.
153	Insect resistance	Insect Resistance and Vector Control, Eighth Report of the Expert Committee on Insecticides, 1958	Standard test methods for determining the susceptibility or resistance of insects to insecticides; bioassay of insecticide deposits on wall surfaces.
158	Medical rehabilitation	Expert Committee on Medical Rehabilitation First Report, 1958	Sources of statistical information and their limitations; classification and definitions required for compiling rehabilitation statistics; selected data on prevalence of physical impairments in some population groups.
162	Malaria	Expert Committee on Malaria, Seventh Report 1959	Survey; surveillance; prediscontinuation appraisal.
164	Health statistics, cancer statistics	Expert Committee on Health Statistics, Sixth Report, including Third Report of the Sub-Committee on Cancer Statistics, 1959	Terms and measurements in the field of morbidity statistics; long-range programme in vital and health statistics; role of statistical methodology in WHO projects; health indicators for measurement of levels of living; methods for measuring incidence and prevalence of cancer; cancer registration; epidemiology of cancer, including geographic, pathological aspects; statistics on results of treatment of cancer; statistical classification, nomenclature and clinical staging of cancer; accuracy of cancer diagnosis on death certificates.
165	Plague	Expert Committee on Plague, Third Report, 1959	Organization and techniques for surveys on wild-rodent plague.
168	Cardiovascular diseases and hypertension	First Report of the the Expert Committee on Cardiovascular Diseases and Hypertension, 1959	Studies on hypertension and coronary heart disease; implications of the International Classification of Diseases; classification and criteria for epidemiological studies.
171	Mental health	Mental Health: Problems of Aging and the Aged, Sixth Report of the Expert Committee on Mental Health, 1959	Demographic background; incidence of mental illness in old age; classification.

APPENDIX IIIa*

WORLD HEALTH ORGANIZATION

REGULATIONS REGARDING

NOMENCLATURE (INCLUDING THE COMPILATION AND PUBLICATION OF STATISTICS) WITH RESPECT TO DISEASES AND CAUSES OF DEATH

(Extract from the Nomenclature Regulations, 1948, as amended by the Additional Regulations of 21 May 1956)

Article 1

Members of the World Health Organization for whom these Regulations shall come into force . . . (hereinafter referred to as Members) shall compile and publish annually for each calendar year statistics of causes of death, in accordance with Articles 2-8, 12, 17-18 of the Regulations and in accordance with the classification, nomenclature and numbering as set out in the Lists given in the *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death,* annexed to the present Regulations. The Lists hereinafter mentioned are the Lists set forth in the Annex. The above-mentioned Manual may be cited as the International Classification of Diseases.

Article 2

Each Member shall code mortality statistics in accordance with the *International Statistical Classification of Diseases, Injuries, and Causes of Death,* with or without four-digit subcategories, and using for the purpose the Tabular List of Inclusions and Alphabetical Index.

Article 3

Each Member shall publish statistics of causes of death in respect of:

(a) its territory as a whole;

Depending on the administrative structure of its territory and its national needs, each Member shall, in addition, publish statistics of causes of death in respect of one or more of the following areas:

(b) each major civil division;

(c) each town or conurbation of 1,000,000 population and over, otherwise the largest town with population of at least 100,000;

(d) national aggregate of urban areas of 100,000 population and over;

(e) national aggregate of urban areas of less than 100,000 population,

(f) national aggregate of rural areas.

Each Member shall append to the statistics referred to under (d)—(f) the definition of "urban" and "rural" applied therein.

Members in whose territory coverage of medical certification of cause of death is incomplete or limited to certain areas shall, in publishing statistics of causes of death, indicate:

* Reproduced, with due acknowledgement to the World Health Organization, from pages 388-393 of the Manual of International Statistical Classification of Diseases, Injuries and Causes of Death, Volume 1.

(i) areas in which medical certification is deemed adequately complete; and/or
(ii) areas with incomplete coverage of medical certification, tabulating medically certified deaths separately from other deaths.

For the purpose of this Article and of Articles 4, 6 and 16, "territory" designates the Metropolitan (home) territory of the Member, and not dependent territories, whether protectorates, colonies, other outlying possessions or territories under trusteeship.

Article 4

Statistics of causes of death in respect of the territory of a Member, taken as a whole, shall be published in accordance with:
(a) the List of three-digit categories of the Classification (Detailed List) with or without four-digit subcategories; or, if this is not possible, in accordance with
(b) the Intermediate List of 150 Causes.

Article 5

Statistics of causes of death in respect of any geographic or other divisions of the territory enumerated in Article 3 shall be published in accordance with:
(a) the Intermediate List of 150 Causes; or, if this is not possible, in accordance with:
(b) the Abbreviated List of 50 Causes.

If they are given in greater detail, without reaching the extent of the Detailed List, they shall be so arranged that, by suitable grouping, they can be reduced to the Intermediate List of 150 Causes or to the Abbreviated List of 50 Causes.

Article 6

In publishing statistics of causes of death by age one of the following age groupings shall be used:
(a) for general puposes:
  (i) under 1 year, single years to 4 years inclusive, five-year groups from 5 to 84 years, 85 years and over;
  (ii) under 1 year, 1-4 years, 5-14 years, 15-24 years, 25-44 years, 45-64 years, 65-74 years, 75 years and over;
  (iii) under 1 year, 1-14 years, 15-44 years, 45-64 years, 65 years and over;
(b) for special statistics of infant mortality:
  (i) by single days for the first week of life (under 1 day, 1, 2, 3, 4, 5, 6 days), 7-13 days, 14-20 days, 21-27 days, 28 days up to but not including 2 months, by single month of life from 2 months to 1 year (2, 3, 4, . . . 11 months);
  (ii) under 7 days, 7-27 days, 28 days up to but not including 3 months, 3-5 months, 6-11 months;
  (iii) under 28 days, 28 days to 11 months inclusive.

If age groupings are published in greater detail than in one of the groupings specified above, they shall be so arranged as to allow condensation into one of these groupings.

Article 7

(a) Statistics of causes of death for the whole territory of the Member shall be published in so far as possible, by sex for the age groups specified in Article 6 (a) (i).
(b) If statistics of causes of death for any geographic or other divisions of the territory enumerated in Article 3 are published by age they shall be by sex for the age groups specified in Article 6 (a) (ii).
(c) If statistics of causes of death for administrative subdivisions are published by age they shall be for the age groups specified in Article 6 (a) (iii).

Article 8

If special statistics of infant mortality for the whole territory of the Member are published by age they shall be for the age groups specified in Article 6 (b) (i).

Article 9

Each Member shall adopt a form of medical certificate of the cause of death that provides for the statement of:
I. the disease or condition directly leading to death, together with such antecedent morbid conditions as may exist, so that the underlying cause of death will be clearly indicated, and
II. such other significant conditions contributing to the death but not related to the disease or condition causing death.

The form of medical certificate of cause of death to be used shall conform as far as possible to the model given in the Annex.

Article 10

As far as possible, medical certification of the cause of death shall be the responsibility of the attending physician.

Article 11

As far as possible, the administrative procedure for the completion, transmission and statistical treatment of the medical certificate of cause of death shall ensure protection of the confidential nature of the medical information contained therein.

Article 12

Each Member shall adopt the underlying cause as the main cause for tabulation of mortality statistics. The selection of the underlying cause from the information stated on the medical certificate of cause of death shall follow the rules given in the Annex.

Article 13

Each Member, when preparing statistics of *morbidity,* shall code the causes of illness in accordance with the *International Statistical Classification of Diseases, Injuries, and Causes of Death* with or without four-digit subcategories, using for the purpose the Tabular List of Inclusions and Alphabetical Index.

Article 14

Each Member, when publishing statistics of morbidity, shall do so in accordance with:

(a) the Detailed List, or

(b) the Intermediate List of 150 Causes, or

(c) such special list appropriate to the purposes of the statistics concerned as may have been recommended by the World Health Assembly.

If they are published in another form the categories selected shall be so arranged that by suitable grouping they can be related to one of the above lists.

If a special list as alluded to in (c) has not yet been recommended by the World Health Assembly, or if a Member is of opinion that such a list, though so recommended, is not appropriate in the circumstances, the Member may adopt its own special list, provided that a copy is forwarded to the Director-General of the Organization for information and study.

Article 15

Statistics of morbidity shall, in so far as possible, be compiled and published in accordance with the sex andage groupings specified in Articles 6, 7 and 8 for mortality statistics.

Article 16

Each Member undertakes to recommend that morbidity statistics published or compiled by autonomous official or non-official institutions and agencies within its territory conform as far as possible with the provisions of Articles 13-17.

Article 17

Each Member, in compiling and publishing mortality and morbidity statistics, shall have regard to such technical recommendations as may be made on these subjects by the World Health Assembly under Article 23 of the Constitution.

Article 18

Each Member shall, under Article 64 of the Constitution, provide the Director-General of the Organization with a copy of the statistics published in accordance with the present Regulations.

APPENDIX IIIb

INTERNATIONAL SANITARY REGULATIONS

The following information pertinent to notifieations of quarantinable diseases is reproduced, with due acknowledgement to the World Health Organization, from the International Sanitary Regulations adopted by the Fourth World Health Assembly in 1951 and amended by the Eighth and Ninth World Health Assemblies in 1955 and 1956. Annotated edition. World Health Organization, 1957, Geneva.

PART I - DEFINITIONS

Article I

For the purposes of these Regulations —

"*Aëdes aegypti index*" means the ratio, expressed as a pereentage, between the number of houses in a limited well-defined area on the premises of whieh aetual breeding-places of *Aëdes aegypti* are found, and the total number of houses examined in that area;

"*epidemic*" means an extension of a quarantinable disease by a multiplication of cases in a loeal area;

"*imported case*" means a case introdueed into a territory;

"*infected local area*" means —

(a) a local area where there is a non-imported case of plague, eholera, yellow fever, or smallpox; or

(b) a loeal area where plague infection among rodents exists on land or on craft whieh are part of the equipment of a port; or

(c) a local area where activity of yellow-fever virus is found in vertebrates other than man; or

(d) a local area where there is an epidemie of typhus or relapsing fever;

"*infected person*" means a person who is suffering from a quarantinable disease, or who is believed to be infected with sueh a disease;

"*isolation*", when applied to a person or group of persons, means the separation of that person or group of persons from other persons, exeept the health staff on duty, in sueh a manner as to prevent the spread of infection;

"*local area*" means —

(a) the smallest area within a territory, whieh may be a port or an airport, having a defined boundary and possessing a health organization whieh is able to apply the appropriate sanitary measures permitted or preseribed by these Regulations; the situation of sueh an area within a larger area which also possesses such a health organization shall not preclude the smaller area from being a local area for the purposes of these Regulations; or

(b) an airport in connexion with which a direct transit area has been established;

"*quarantinable diseases*" means plague, eholera, yellow fever, smallpox, typhus, and relapsing fever;

"*relapsing fever*" means louse-borne relapsing fever;

"*suspect*" means a person who is considered by the health authority as having been exposed to infection by a quarantinable disease and is eonsidered eapable of spreading that disease;

"*typhus*" means louse-borne typhus;

"*yellow-fever receptive area*" means an area in whieh the virus of yellow fever does not exist but where the presenee of *Aëdes aegypti* or any other domieiliary or peri-domieiliary vector of yellow fever would permit its development if introduced.

PART II - NOTIFICATIONS AND EPIDEMIOLOGICAL INFORMATION

Article 2

For the application of these Regulations, each State recognizes the right of the Organization to communicate directly with the health administration of its territory or territories. Any notification or information sent by the Organization to the health administration shall be considered as having been sent to the State, and any notification or information sent by the health administration to the Organization shall be considered as having been sent by the State.

Article 3

1. Each health administration shall notify the Organization by telegram within twenty-four hours of its being informed that a local area has become an infected local area.
2. The existence of the disease so notified on the establishment of a reasonably certain clinical diagnosis shall be confirmed as soon as possible by laboratory methods, as far as resources permit, and the result shall be sent immediately to the Organization by telegram.

Article 4

1. Any notification required under paragraph 1 of Article 3, except in the case of rodent plague, shall be promptly supplemented by information as to the source and type of the disease, the number of cases and deaths, the conditions affecting the spread of the disease, and the prophylactic measures taken.
2. In the case of rodent plague, the notification required under paragraph 1 of Article 3 shall be supplemented by monthly reports on the number of rodents examined and the number found infected.

Article 5

1. During an epidemic the notifications and information required under Article 3 and paragraph 1 of Article 4 shall be followed by subsequent communications sent at regular intervals to the Organization.
2. These communications shall be as frequent and as detailed as possible. The number of cases and deaths shall be communicated at least once a week. The precautions taken to prevent the spread of the disease, in particular the measures which are being applied to prevent the spread of the disease to other territories by ships, aircraft, trains, or road vehicles leaving the infected local area, shall be stated. In the case of plague, the measures taken against rodents shall be specified. In the case of the quarantinable diseases which are transmitted by insect vectors, the measures taken against such vectors shall also be specified.

Article 6

1. The health administration for a territory in which an infected local area is situated shall notify the Organization when that local area is free from infection.
2. An infected local area may be considered as free from infection when all measures of prophylaxis have been taken and maintained to prevent the recurrence of the disease or its spread to other areas, and when —

(a) in the case of plague, cholera, smallpox, typhus, or relapsing fever, a period of time equal to twice the incubation period of the disease, as hereinafter provided, has elapsed since the last case indentified has died, recovered or been isolated, and infection from that disease has not occurred in any other local area in the vicinity, provided that, in the case of plague with rodent plague also present, the period specified under sub-paragraph (c) of this paragraph has elapsed;

(b) (i) in the case of yellow fever not transmitted by *Aëdes aegypti*, three months have elapsed without evidence of activity of the yellow-fever virus;

(ii) in the case of yellow fever transmitted by *Aëdes aegypti* three months have elapsed since the occurrence of the last human case, or one month since that occurrence if the *Aëdes aegypti* index has been continuously maintained below one per cent;

(c) in the case of rodent plague, one month has elapsed after suppression of the epizootic.

Article 7

Each health administration shall notify the Organization immediately of evidence of the presence of the virus of yellow fever in any part of its territory where it has not previously been recognized, and shall report the extent of the area involved.

Article 8

1. Each health administration shall notify the Organization of —

(a) any change in its requirements as to vaccination for any international voyage;

(b) the measures which it has decided to apply to arrivals from an infected local area and the withdrawal of any such measures, indicating the date of application or withdrawal.

2. Any such notification shall be sent by telegram, and whenever possible in advance of any such change or of the application or withdrawal of any such measure.

3. Each health administration shall send to the Organization once a year, at a date to be fixed by the Organization, a recapitulation of its requirements as to vaccination for any international voyage.

Article 9

In addition to the notifications and information required under Articles 3 to 8 inclusive, each health administration shall send to the Organization weekly —

(a) a report by telegram of the number of cases of the quarantinable diseases and deaths therefrom during the previous week in each of its towns and cities adjacent to a port or an airport;

(b) a report by airmail of the absence of such cases during the periods referred to in sub-paragraphs (a), (b), and (c) of paragraph 2 of Article 6.

Article 10

Any notification and information required under Articles 3 to 9 inclusive shall also be sent by the health administration, on request, to any diplomatic mission or consulate established in the territory for which it is responsible.

Article 11

The Organization shall send to all health administrations, as soon as possible and by the means appropriate to the circumstances, all epidemiological and other information which it has received under Articles 3 to 8 inclusive and paragraph (a) of Article 9 as well as information as to the absence of any returns required by Article 9. Communications of an urgent nature shall be sent by telegram or telephone.

Article 12

Any telegram sent, or telephone call made, for the purposes of Articles 3 to 8 inclusive and Article 11 shall be given the priority appropriate to the circumstances; in any case of exceptional urgency, where there is risk of the spread of a quarantinable disease, the priority shall be the highest available under international telecommunication agreements.

Article 13

1. Each State shall forward annually to the Organization, in accordance with Article 62 of the Constitution of the Organization, information concerning the occurrence of any case of a quarantinable disease due to or carried by international traffic, as well as on the action taken under these Regulations or bearing upon their application.

2. The Organization shall, on the basis of the information required by paragraph 1 of this Article, of the notifications and reports required by these Regulations, and of any other official information, prepare an annual report on the functioning of these Regulations and on their effect on international traffic.

APPENDIX IV*

SPECIAL TABULATION LISTS

List A. Intermediate List of 150 Causes for Tabulation of Morbidity and Mortality

List B. Abbreviated List of 50 Causes for Tabulation of Mortality

List C. Special List of 50 Causes for Tabulation of Morbidity for Social Security Purposes

* Reproduced, with due acknowledgement to the World Health Organization, from pages 373-385 of the Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death, Volume 1.

APPENDIX IV

LIST A

INTERMEDIATE LIST OF 150 CAUSES FOR TABULATION OF MORBIDITY AND MORTALITY

Note. — In publishing statistics, clearly indicate the Detailed List categories included in each tabulated cause group.

	Cause Groups	*Detailed List Numbers*
A 1	Tuberculosis of respiratory system	001-008
A 2	Tuberculosis of meninges and central nervous system	010
A 3	Tuberculosis of intestines, peritoneum, and mesenteric glands	011
A 4	Tuberculosis of bones and joints	012, 013
A 5	Tuberculosis, all other forms	014-19
A 6	Congenital syphilis	020
A 7	Early syphilis	021
A 8	Tabes dorsalis	024
A 9	General paralysis of insane	025
A10	All other syphilis	022, 023 026-029
A11	Gonococcal infection	030-035
A12	Typhoid fever	040
A13	Paratyphoid fever and other Salmonella infections	041, 042
A14	Cholera	043
A15	Brucellosis (undulant fever)	044
A16	Dysentery, all forms	045-048
A17	Scarlet fever	050
A18	Streptococcal sore throat	051
A19	Erysipelas	052
A20	Septicaemia and pyaemia	053
A21	Diphtheria	055
A22	Whooping Cough	056
A23	Meningococcal infections	057
A24	Plague	058
A25	Leprosy	060
A26	Tetanus	061
A27	Anthrax	062
A28	Acute poliomyelitis	080
A29	Acute infectious encephalitis	082
A30	Late effects of acute poliomyelitis and acute infectious encephalitis	081, 083
A31	Smallpox	084
A32	Measles	085
A33	Yellow fever	091
A34	Infectious hepatitis	092
A35	Rabies	094
A36	Typhus and other rickettsial diseases	100-108
A37	Malaria	110-117
A38	Schistosomiasis	123
A39	Hydatid disease	125
A40	Filariasis	127
A41	Ankylostomiasis	129
A42	Other diseases due to helminths	124, 126 128, 130

	Cause Groups	*Detailed List Numbers*
A43	All other diseases classified as infective and parasitic	036-039, 049, 054,059, 063-074, 086-090, 093, 095, 096, 120-122, 131-138
A44	Malignant neoplasm of buccal cavity and pharynx	140-148
A45	Malignant neoplasm of oesophagus	150
A46	Malignant neoplasm of stomach	151
A47	Malignant neoplasm of intestine, except rectum	152,153
A48	Malignant neoplasm of rectum	154
A49	Malignant neoplasm of larynx	161
A50	Malignant neoplasm of trachea, bronchus and lung, not specified as secondary	162, 163
A51	Malignant neoplasm of breast	170
A52	Malignant neoplasm of cervix uteri	171
A53	Malignant neoplasm of other and unspecified parts of uterus	172-174
A54	Malignant neoplasm of prostate	177
A55	Malignant neoplasm of skin	190, 191
A56	Malignant neoplasm of bone and connective tissue	196, 197
A57	Malignant neoplasm of all other and unspecified sites	155-160, 164, 165, 175, 176, 178-181, 192-195, 198, 199
A58	Leukaemia and aleukaemia	204
A59	Lymphosarcoma and other neoplasms of lymphatic and haematopoietic system	200-203, 205
A60	Benign neoplasms and neoplasms of unspecified nature	210-239
A61	Non-toxic goiter	250, 251
A62	Thyrotoxicosis with or without goiter	252
A63	Diabetes mellitus	260
A64	Avitaminosis and other deficiency states	280-286
A65	Anaemias	290-293
A66	Allergic disorders; all other endocrine, metabolic, and blood diseases	240-245, 253,254, 270-277, 287-289, 294-299
A67	Psychoses	300-309
A68	Psychoneuroses and disorders of personality	310-324, 326
A69	Mental deficiency	325
A70	Vascular lesions affecting central nervous system	330-334
A71	Non-meningococcal meningitis	340
A72	Multiple sclerosis	345
A73	Epilepsy	353
A74	Inflammatory diseases of eye	370-379
A75	Cataract	385
A76	Glaucoma	387
A77	Otitis media and mastoiditis	391-393
A78	All other diseases of the nervous system and sense organs	341-344, 350-352, 354-369, 380-384, 386, 388-390, 394-398

Cause Groups		*Detailed List Numbers*
A 79	Rheumatic fever	400-402
A 80	Chronic rheumatic heart disease	410-416
A 81	Arteriosclerotic and degenerative heart disease	420-422
A 82	Other diseases of heart	430-434
A 83	Hypertension with heart disease	440-443
A 84	Hypertension without mention of heart	444-447
A 85	Diseases of arteries	450-456
A 86	Other diseases of circulatory system	460-468
A 87	Acute upper respiratory infections	470-475
A 88	Influenza	480-483
A 89	Lobar pneumonia	490
A 90	Bronchopneumonia	491
A 91	Primary atypical, other, and unspecified pneumonia	492, 493
A 92	Acute bronchitis	500
A 93	Bronchitis, chronic and unqualified	501, 502
A 94	Hypertrophy of tonsils and adenoids	510
A 95	Empyema and abscess of lung	518, 521
A 96	Pleurisy	519
A 97	All other respiratory diseases	511-517 520 522-527
A 98	Diseases of teeth and supporting structures	530-535
A 99	Ulcer of stomach	540
A100	Ulcer of duodenum	541
A101	Gastritis and duodenitis	543
A102	Appendicitis	550-553
A103	Intestinal obstruction and hernia	560, 561 570
A104	Gastro-enteritis and colitis, except diarrhoea of the newborn	571, 572
A105	Cirrhosis of liver	581
A106	Cholelithiasis and cholecystitis	584, 585
A107	Other diseases of digestive system	536-539 542, 544 545 573-580 582-583 586, 587
A108	Acute nephritis	590
A109	Chronic, other, and unspecified nephritis	591-594
A110	Infections of kidney	600
A111	Calculi of urinary system	602, 604
A112	Hyperplasia of prostate	610
A113	Diseases of breast	620, 621
A114	Other diseases of genito-urinary system	601, 603 605-609 611-617 622-637
A115	Sepsis of pregnancy, childbirth, and the puerperium	640, 641 681, 682 684
A116	Toxaemias of pregnancy and the puerperium	642, 652 685, 686
A117	Haemorrhage of pregnancy and childbirth	643, 644 670-672
A118	Abortion without mention of sepsis or toxaemia	650
A119	Abortion with sepsis	651

	Cause Groups	*Detailed List Numbers*
A120	Other complications of pregnancy, childbirth, and the puerperium. Delivery without mention of complication	645-649, 660, 673-680, 683, 687-689
A121	Infections of skin and subcutaneous tissue	690-698
A122	Arthritis and spondylitis	720-725
A123	Muscular rheumatism and rheumatism unspecified	726,727
A124	Osteomyelitis and periostitis	730
A125	Ankylosis and acquired musculoskeletal deformities	737, 745-749
A126	All other diseases of skin and musculoskeletal system	700-716, 731-736, 738-744
A127	Spina bifida and meningocele	751
A128	Congenital malformations of circulatory system	754
A129	All other congenital malformations	750,752, 753, 755-759
A130	Birth injuries	760,761
A131	Postnatal asphyxia and atelectasis	762
A132	Infections of the newborn	763-768
A133	Haemolytic disease of the newborn	770
A134	All other defined diseases of early infancy	769, 771,772
A135	Ill-defined diseases peculiar to early infancy, and immaturity unqualified	773,776
A136	Senility without mention of psychosis	794
A137	Ill-defined and unknown causes of morbidity and mortality	780-793, 795

"E" CODE. ALTERNATIVE CLASSIFICATION OF ACCIDENTS, POISONINGS, AND VIOLENCE (EXTERNAL CAUSE)

AE138	Motor vehicle accidents	E810-E835
AE139	Other transport accidents	E800-E802, E840-E866
AE140	Accidental poisoning	E870-E895
AE141	Accidental falls	E900-E904
AE142	Accident caused by machinery	E912
AE143	Accident caused by fire and explosion of combustible material	E916
AE144	Accident caused by hot substance, corrosive liquid, steam, and radiation	E917,E918
AE145	Accident caused by firearm	E919
AE146	Accidental drowning and submersion	E929
AE147	All other accidental causes	E910,E911, E913-E915, E920-E928, E930-E962
AE148	Suicide and self-inflicted injury	E963, E970-E979
AE149	Homicide and injury purposely inflicted by other persons (not in war)	E964, E980-E985
AE150	Injury resulting from operations of war	E965, E990-E999

"N" CODE. ALTERNATIVE CLASSIFICATION OF ACCIDENTS, POISONINGS, AND VIOLENCE (NATURE OF INJURY)

AN138	Fracture of skull	N800-N804

	Cause Groups	*Detailed List Numbers*
AN139	Fracture of spine and trunk	N805-N809
AN140	Fracture of limbs	N810-N829
AN141	Dislocation without fracture	N830-N839
AN142	Sprains and strains of joints and adjacent muscle	N840-N848
AN143	Head injury (excluding fracture)	N850-N856
AN144	Internal injury of chest, abdomen, and pelvis	N860-N869
AN145	Laceration and open wounds	N870-N908
AN146	Superficial injury, contusion and crushing with intact skin surface	N910-N929
AN147	Effects of foreign body entering through orifice	N930-N936
AN148	Burns	N940-N949
AN149	Effects of poisons	N960-N979
AN150	All other and unspecified effects of external causes	N950-N959 N980-N999

LIST B

ABBREVIATED LIST OF 50 CAUSES FOR TABULATION OF MORTALITY

NOTE. - In publishing statistics, clearly indicate the Detailed List categories included in each tabulated cause group.

	Cause Groups	*Detailed List Numbers*
B 1	Tuberculosis of respiratory system	001-008
B 2	Tuberculosis, other forms	010-019
B 3	Syphilis and its sequelae	020-029
B 4	Typhoid fever	040
B 5	Cholera	043
B 6	Dysentery, all forms	045-048
B 7	Scarlet fever and streptococcal sore throat	050, 051
B 8	Diphtheria	055
B 9	Whooping cough	056
B10	Meningococcal infections	057
B11	Plague	058
B12	Acute poliomyelitis	080
B13	Smallpox	084
B14	Measles	085
B15	Typhus and other rickettsial diseases	100-108
B16	Malaria	110-117
B17	All other diseases classified as infective and parasitic	030-039 041,042 044, 049 052-054 059-074 081-083 086-096 120-138
B18	Malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissues	140-205
B19	Benign neoplasms and neoplasms of unspecified nature	210-239
B20	Diabetes mellitus	260
B21	Anaemias	290-293
B22	Vascular lesions affecting central nervous system	330-334
B23	Non-meningococcal meningitis	340
B24	Rheumatic fever	400-402
B25	Chronic rheumatic heart disease	410-416
B26	Arteriosclerotic and degenerative heart disease	420-422
B27	Other diseases of heart	430-434
B28	Hypertension with heart disease	440-443

	Cause Groups	*Detailed List Numbers*
B29	Hypertension without mention of heart	444-447
B30	Influenza	480-483
B31	Pneumonia	490-493
B32	Bronchitis	500-502
B33	Ulcer of stomach and duodenum	540, 541
B34	Appendicitis	550-553
B35	Intestinal obstruction and hernia	560, 561, 570
B36	Gastritis, duodenitis, enteritis, and colitis, except diarrhoea of the newborn	543, 571, 572
B37	Cirrhosis of liver	581
B38	Nephritis and nephrosis	590-594
B39	Hyperplasia of prostate	610
B40	Deliveries and complications of pregnancy, childbirth, and the puerperium	640-689
B41	Congenital malformations	750-759
B42	Birth injuries, postnatal asphyxia and atelectasis	760-762
B43	Infections of the newborn	763-768
B44	Other diseases peculiar to early infancy, and immaturity unqualified	769-776
B45	Senility without mention of psychosis, ill-defined and unknown causes	780-795
B46	All other diseases	Residual

"E" CODE. ALTERNATIVE CLASSIFICATION OF ACCIDENTS, POISONINGS, AND VIOLENCE (EXTERNAL CAUSE)

BE47	Motor vehicle accidents	E810-E835
BE48	All other accidents	E800-E802, E840-E962
BE49	Suicide and self-inflicted injury	E963, E970-E979
BE50	Homicide and operations of war	E964, E965, E980-E999

"N" CODE. ALTERNATIVE CLASSIFICATION OF ACCIDENT, POISONINGS, AND VIOLENCE (NATURE OF INJURY)

BN47	Fractures, head injuries, and internal injuries	N800-N829, N850-N869
BN48	Burns	N940-N949
BN49	Effects of poisons	N960-N979
BN50	All other injuries	N830-N848, N870-N936, N950-N959, N980-N999

LIST C

SPECIAL LIST OF 50 CAUSES FOR TABULATION OF MORBIDITY FOR SOCIAL SECURITY PURPOSES

NOTE. - In publishing statistics, clearly indicate the Detailed List categories included in each tabulated cause group.

	Cause Groups	*Detailed List Numbers*
C 1	Tuberculosis of respiratory system	001-008
C 2	Tuberculosis, other forms	010-019
C 3	Syphilis and its sequelae	020-029
C 4	Gonococcal infection	030-035

Cause Groups		*Detailed List Numbers*
C 5	Dysentery, all forms	045-048
C 6	Other infective diseases commonly arising in intestinal tract	040-044, 049
C 7	Certain diseases common among children	050, 055, 056,085, 089
	C7a Scarlet fever	050
	C7b Diphtheria	055
	C7c Whooping cough	056
	C7d Measles	085
	C7e Mumps	089
C 8	Typhus and other rickettsial diseases	100-108
C 9	Malaria	110-117
C10	Diseases due to helminths	123-130
C11	All other diseases classified as infective and parasitic	036-039, 051-054, 057-084, 086-088, 090-096, 120-122, 131-138
C12	Malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissues	140-205
C13	Benign neoplasms and neoplasms of unspecified nature	210-239
C14	Allergic disorders	240-245
C15	Diseases of thyroid gland	250-254
C16	Diabetes mellitus	260
C17	Avitaminosis and other deficiency states	280-286
C18	Anaemias	290-293
C19	Psychoneuroses and psychoses	300-318
C20	Vascular lesions affecting central nervous system	330-334
C21	Diseases of eye	370-389
C22	Diseases of ear and mastoid process	390-398
C23	Rheumatic fever	400-402
C24	Chronic rheumatic heart disease	410-416
C25	Arteriosclerotic and degenerative heart disease	420-422
C26	Hypertensive disease	440-447
C27	Diseases of veins	460-466
C28	Acute nasopharyngitis (common cold)	470
C29	Acute pharyngitis and tonsillitis, and hypertrophy of tonsils and adenoids	472, 473, 510
C30	Influenza	480-483
C31	Pneumonia	490-493, 763
C32	Bronchitis	500-502
C33	Silicosis and occupational pulmonary fibrosis	523, 524
C34	All other respiratory diseases	471,474, 475, 511-522, 525-527
C35	Diseases of stomach and duodenum, except cancer	540-545
C36	Appendicitis	550-553
C37	Hernia of abdominal cavity	560, 561
C38	Diarrhoea and enteritis	571, 764
C39	Diseases of gallbladder and bile ducts	584-586
C40	Other diseases of digestive system	530-539, 570, 572-583, 587
C41	Nephritis and nephrosis	590-594
C42	Diseases of genital organs	610-637
	C42a Diseases of male genital organs	610-617
	C42b Diseases of female genital organs	620-637

Cause Groups		*Detailed List Numbers*
C43	Deliveries and complications of pregnancy, childbirth, and the puerperium	640-689
	C43a Normal deliveries	660
	C43b Complications of pregnancy, childbirth, and the puerperium	640-652, 670-689
C44	Boil, abscess, cellulitis and other skin infections	690-698
C45	Other diseases of skin	700-716
C46	Arthritis and rheumatism, except rheumatic fever	720-727
C47	Diseases of bones and other organs of movement	730-749
C48	Congenital malformations and diseases peculiar to early infancy	750-762, 765-776
C49	Other specified and ill-defined diseases	Residual
C50	Accidents, poisonings, and violence (external cause)	E800-E999
	C50a Occupational accidents and occupational poisonings	E800-E965
	C50b Accidents and poisonings not specified as occupational	E800-E965
	C50c Other violence	E970-E999

APPENDIX V

UN CHECKLIST FOR STATISTICAL LEGISLATION*

I. Introduction
   1. Title of the Act, Law, Ordinance, etc.
   2. Definitions of terms used in the legislation

II. Statistical Organization and Co-ordination

A. *General:*

Defining the structure of the national statistical system and the status, powers, duties and relationships of all organs and offices at the various levels.

B. *Central statistical office:*
   1. Creating a central statistical office, i.e. generally the main operating statistical bureau, regardless of its name.
   2. Location of the central statistical office.
   3. Defining the internal structure of the central statistical office and the duties of its branches or sections.
   4. Defining the operating functions of the central statistical office
      (a) To collect, compile, publish and analyse statistics.
      (b) To furnish and disseminate statistical information.
      (c) To organize and conduct national censuses.
      (d) To organize and conduct statistical surveys.
      (e) To conduct statistical research and develop standards.
      (f) To compile and publish a statistical abstract or yearbook of the country.
      (g) To exchange statistical publications and maintain library services.
      (h) To establish and maintain a permanent record of the statistical activities.
      (i) To prepare annually a working programme and budget.
      (j) To recruit and control statistical personnel, including transfers, loans, etc.
      (k) To request from all government officials data and background information relating to statistics.
   5. Defining relations with other offices
      (a) To advise on and co-ordinate the statistical work of all offices.
      (b) To direct and control the statistical work of all offices.
      (c) To develop and maintain a co-ordinated system of statistics.
      (d) To develop programmes, issue regulations, etc., for the improvement of national statistics.
      (e) To promote and maintain the application of statistical standards.
      (f) To co-operate with all other offices in the production of statistics.
      (g) To allocate the conduct of statistical operations.
      (h) To supervise and approve all statistical operations.
      (i) To promote and develop statistical training within the country, especially for government statistical personnel.
      (j) To make periodic reports and recommendations (based or not based on surveys) to the proper authority on the statistical services, activities and personnel.
      (k) To review questionnaires, report forms and related documents.
      (l) To sponsor national statistical conferences and societies.
      (m) To promote and assist non-governmental statistical activities.
      (n) To co-operate with foreign and international statistical organizations.
      (o) To co-ordinate the use of mechanical equipment.

C. *Statistical co-ordinating body*
   1. Creating a statistical co-ordinating body (National Committee on Vital and Health Statistics) including general functions, composition, structure, secretariat, etc.

* Legal Provisions for a National Statistics System. Extract, with due acknowledgement to the United Nations, from Chapter 5 of UN Handbook of Statistical Organization. Studies in Methods, Series F, No 6, 1954. New York.

2. Placing the statistical co-ordinating body directly under a ministry.
3. Defining the functions of the co-ordinating body (see also WHO Technical Report Series No. 85):
   (a) To plan and promote the improvement, development and co-ordination of statistics and the elimination of duplication.
   (b) To plan and direct, generally, the statistical activities.
   (c) To prepare annual statistical programmes.
   (d) To investigate the needs of various offices for statistical information from respondents and other offices.
   (e) To investigate the methods used by various offices in obtaining statistical information.
   (f) To maintain a continuing study for the improvement of the statistical work of the various offices.
   (g) To develop programmes, issue regulations and orders for the collection, compilation, analysis and publication of reports.
   (h) To co-ordinate the collecting offices with a view to minimizing the reporting burden, eliminating duplication and the collection of unnecessary information, reducing costs, etc.
   (i) To designate a collecting office which shall collect data for two or more offices.
   (j) To have power of final decision in authorizing statistical projects or operations.
   (k) To make appropriate arrangements for improving statistical work involving relationships between two or more offices.
   (l) To assist the offices, by other means, to improve their statistical work.
   (m) To review the budget estimates of statistical offices.
   (n) To review questionnaires, report forms and related documents.
   (o) To develop and promote the application of statistical standards (including international recommendations).
   (p) To require any office to provide information to other offices (except tax bureaux, military services, etc.)
   (q) To provide for interchange of information, calculated to improve statistical work.
   (r) To determine and arrange with the departments and offices concerned, the furnishing of statistical information to intergovernmental organizations, except for restricted or confidential information.
   (s) To co-operate with national groups of scientists and specialists in statistics and related fields.
   (t) To make periodic reports and recommendations to the proper authority on the statistical services, activities and personnel.
   (u) To publish a bulletin of its activities and related matters.
4. Designating various government departments and offices to participate and co-operate in the work of the co-ordinating body.

III. Statistical Data

A. *Respondents and access to data*

1. Power of the proper statistical authority to call for information and returns for statistical purposes.
2. Obligation to furnish data and information by offices and respondents.
3. Specifying the type of respondents obliged to furnish data and information.
4. Vesting power in the central statistical organization, or persons designated, to compel disclosure of any facts or figures; methods of enforcement.
5. Access to records by statistical personnel.
6. Right of competent officials to enter any dwellings or offices in cases of doubtful information and access to any relevant document or record requested.
7. Special or new statistical surveys to be authorized by specific legislation.

B. *Fields and methods of collection*

1. Specifying the statistics which the central statistical organization (or other) shall collect, compile, analyse, abstract and publish (including coverage, periodicity, methods, particulars, etc.)
2. Authorizing the collection of statistics by means of sampling.
3. Leaving notice at home or place of business as sufficient requirement to fill up and sign form.

C. *Confidentiality of information and penalties*

1. All collected information to be kept confidential and to be used only for statistical purposes.
2. No individual return to be published or divulged.
3. No report to reveal individual particulars.
4. Improperly divulging information; penalty.
5. Disclosing confidential information; penalty.
6. Unauthorized use of information; penalty.
7. False declaration; penalty.
8. Obtaining or seeking information for which the person is not authorized.
9. Refusal to answer; penalty except for questions specifically excluded.
10. Neglect or delay in providing information; penalty.
11. Forged information; deception; penalty.
12. Wilful refusal or neglect to grant access to records; penalty.
13. Personal liability for damage by officials in case of negligence, etc.
14. Preventing another person from furnishing the information requested; penalty.
15. Conditions under which statistical data may be released by one office to another (or individual).
16. Conditions under which statistical data may be published and disseminated.
17. Judicial jurisdiction and procedure for application of penalties under statistical legislation.
18. Prosecution under legislation only with sanction of proper authority.
19. No prosecution for violations in good faith; for foreign diplomats, etc.
20. Time limit for prosecution for offences against the statistical legislation.
21. Application of fines imposed and recovered under the statistical legislation.

IV. Statistical Personnel

1. Appointment and replacement of the head of the central statistical organization (i.e. chief statistical officer or head of the co-ordinating body).
2. Making the head of the central statistical organization responsible for its functioning.
3. Appointment, management, and replacement of the statistical personnel; qualifications for appointment.
4. Additional personnel drawn from professional groups, university students, etc.
5. Giving to state and municipal employees status of agents of central statistical organization (or co-ordinating body) while performing statistical work.
6. Persons required to perform statistical and census work as a public service; persons exempted.
7. Establishing provincial and local statistical agents (temporary or permanent).
8. Authorizing the detailing or transfer of statistical personnel (either on permanent or temporary basis).
9. Oath of office and attestation; promise of fidelity and confidentiality.
10. Duty of personnel to conform to instructions; penalty for forgery, etc.
11. Refusal or desertion from duty; penalty.
12. Rates of remuneration of census and other statistical personnel.

V. Implementation and other Matters

1. Minister or other authority charged with the implementation of the statistical legislation.
2. Proper authority to make rules for the implementation of the statistical legislation; conditions to amend or abrogate such rules.
3. Determining the financial resources and budgetary arrangements for implementing the statistical legislation.
4. Authorizing agreements with provincial, state, or equivalent governments for the implementation of the statistical legislation (in particular for delegating authority to any provincial office or equivalent); collection by any provincial department or officer of any statistical information; supplying of statistical information by any provincial department or officer.
5. Correspondence, cables, forms, or materials relating to official statistics to be sent free of charge while following regulations; penalties.
6. Right to direct correspondence with all respondents.
7. All statistics prepared for publication to be approved by the parliament, head of the government, minister, co-ordinating body or central statistical organization.
8. Fixing the date when the legislation becomes effective.
9. Repeal of conflicting legislation.

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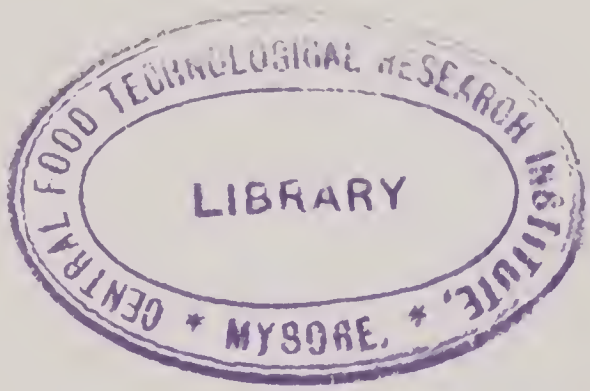
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